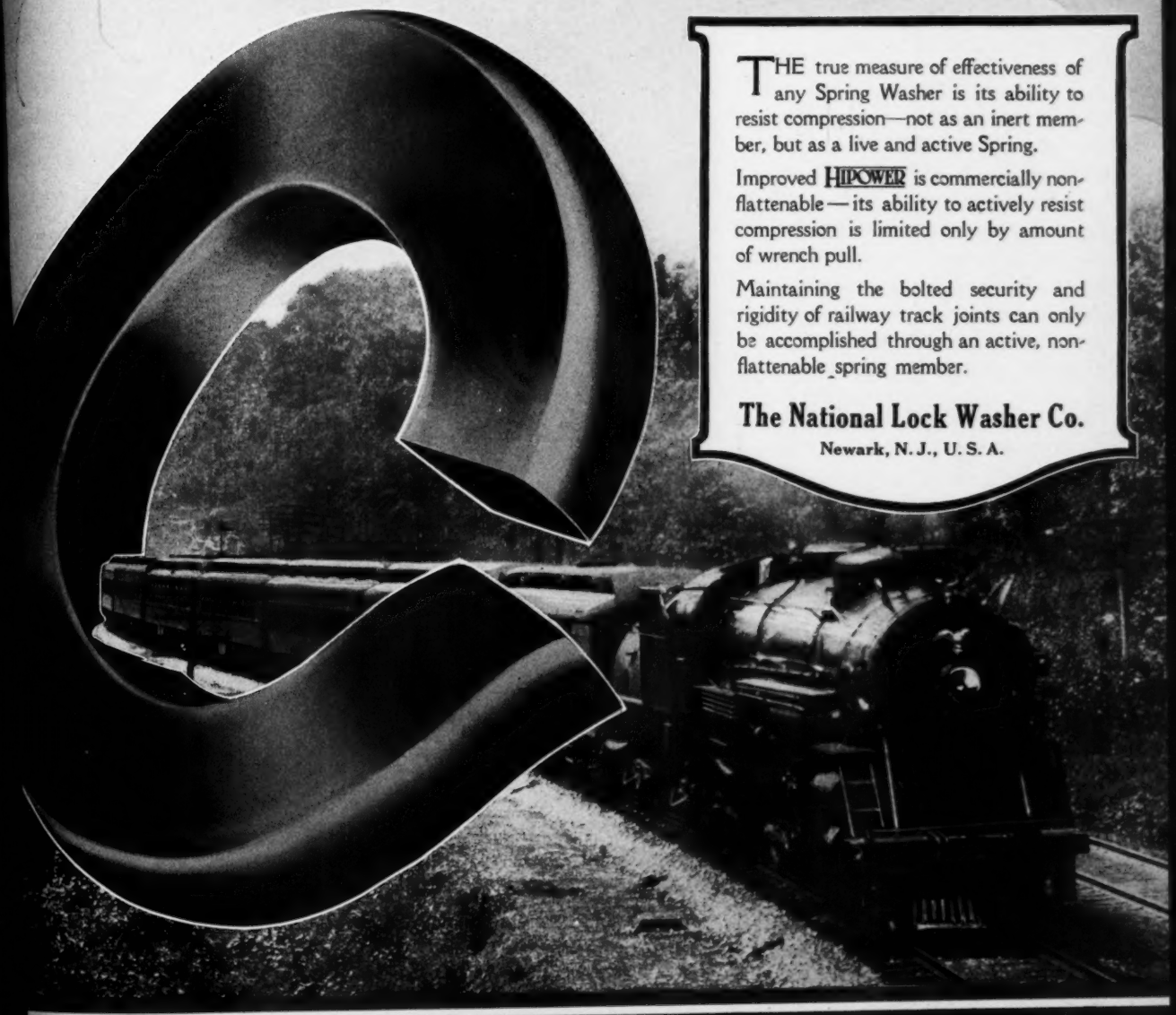
APRIL, 1924

Railway Engineering and Maintenance



THE true measure of effectiveness of any Spring Washer is its ability to resist compression—not as an inert member, but as a live and active Spring.

Improved HIPOWER is commercially non-flattenable—its ability to actively resist compression is limited only by amount of wrench pull.

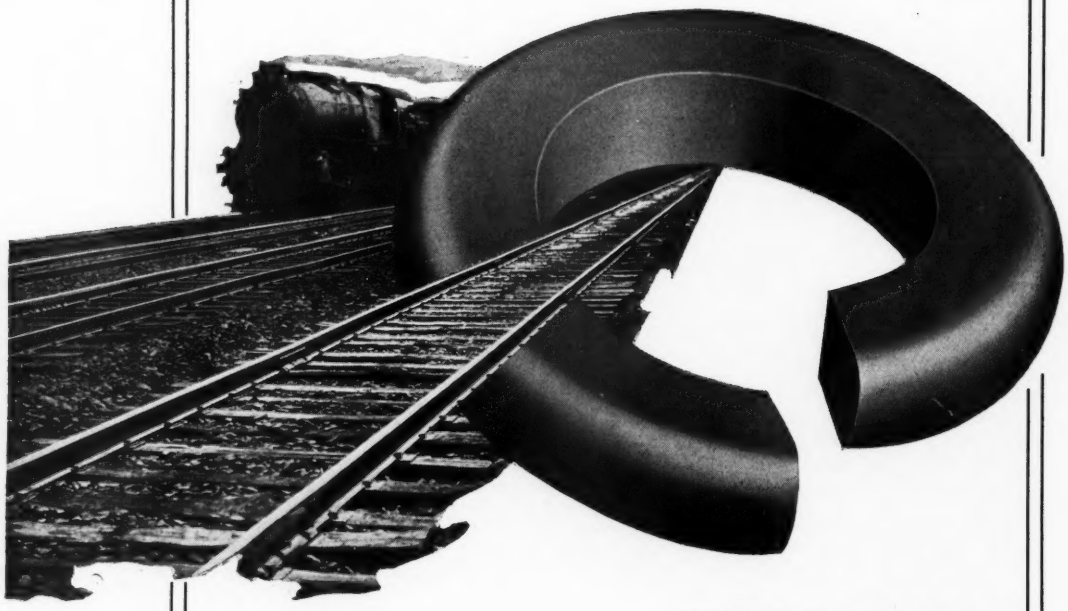
Maintaining the bolted security and rigidity of railway track joints can only be accomplished through an active, non-flattenable spring member.

The National Lock Washer Co.

Newark, N. J., U. S. A.

IMPROVED

HIPOWER



HY-CROME
Nut Locks

UNCERTAIN reliability in a nut lock is a definite irretrievable loss.

Hy-Crome Nut Locks combine all the qualities and features of efficient, economical service—they keep track joints permanently tight.

Reliance manufacturing resources are behind this guarantee of unvarying low cost dependability.

The Reliance Manufacturing Co.
Massillon, Ohio

BRANCH OFFICES: New York, Cleveland, Detroit, Chicago, St. Louis, San Francisco.

AGENTS: W. H. Ziegler Company, Minneapolis, Minn.; Southwest Sales & Equipment Co., Los Angeles, Cal.; Crear, Adams & Company, Chicago, Ill.; Norman S. Kenny Company, Baltimore, Md.; Flemming & Cardoza, Richmond, Va.; Shapleigh Hardware Co., St. Louis, Mo.; Engineering Materials, Ltd., Montreal, Que.

RAILWAY ENGINEERING AND MAINTENANCE
Entered as second-class matter June 23, 1916, at the post office at Chicago, Ill., under the Act of March 3, 1879. Published Monthly by Simmons-Boardman

Narrow Gauge "Mudge" in Rocky Mountain Service

The Service That Goes With Mudge Motor Cars

A complete line of cars for you to choose from.

Design, material and workmanship of the highest quality.

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AIR COOLED — DIRECT CONNECTED
ALWAYS READY

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Manufacturers—Railroad Equipment
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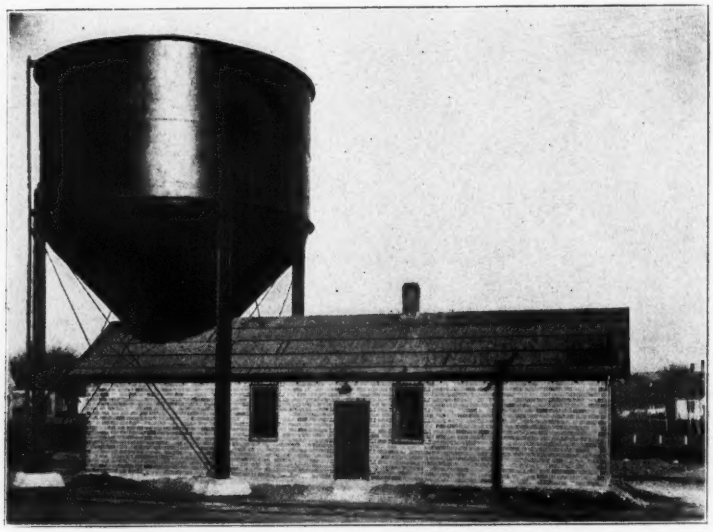
Announcing
The HORTON Ground-Operated Water-Softening Plant



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Completely ground-operated.

Upflow of water and chemical has variable rate; rapid at first, with decrease as settling commences. Average rate of upflow very low.

Sludge accumulates in small area.

Sludge removal very rapid.

Sludge removal very economical; does not waste water.

Rate of delivery of raw water is kept constant by rate of flow controller, as long as supply furnishes as much or more water as the controller is set to let into the tank.

Chemical proportionment is at constant rate, but when supply of raw water falls below a predetermined quantity the amount of chemical automatically adapts itself to the condition.

Chemical mixing tank with paddles on horizontal shaft assures uniform solution.

No climbing to the top of tank necessary.

All machinery on ground level.

All parts requiring attention are conveniently located in respect to each other.

Write for a Descriptive Bulletin

Chicago Bridge & Iron Works

278

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Single Track Signaling on C. B. & Q.

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 20 April, 1924 Number 4

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WOULD YOU LIKE TO KNOW

How to build gravel-packed wells?

How to tell when rail requires renewal?

The best way to cut a rail?

How to keep a painting record?

How jacks were dispensed with in repairing bridge piers?

Answers to these and other practical questions will be found elsewhere in this issue.

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Is better than Maybe
TIE renewal time will soon be here, and the buying of ties is now well advanced. Have you considered the big advantages of early tie buying, or do you prefer to postpone your tie purchases until the time when everybody is scrambling for ties —when roads are competing frantically with each other for ties—when prices go up in the woods and quality goes down.
Don't take a chance. Contract now with International—POSITIVELY is better than MAYBE. International has been accumulating and seasoning ties for treatment and delivery this spring. By contracting now International assures you the specified quantity of ties—every one sound, full size, well seasoned, properly graded, effectively treated and permanently marked with the International dating nail.
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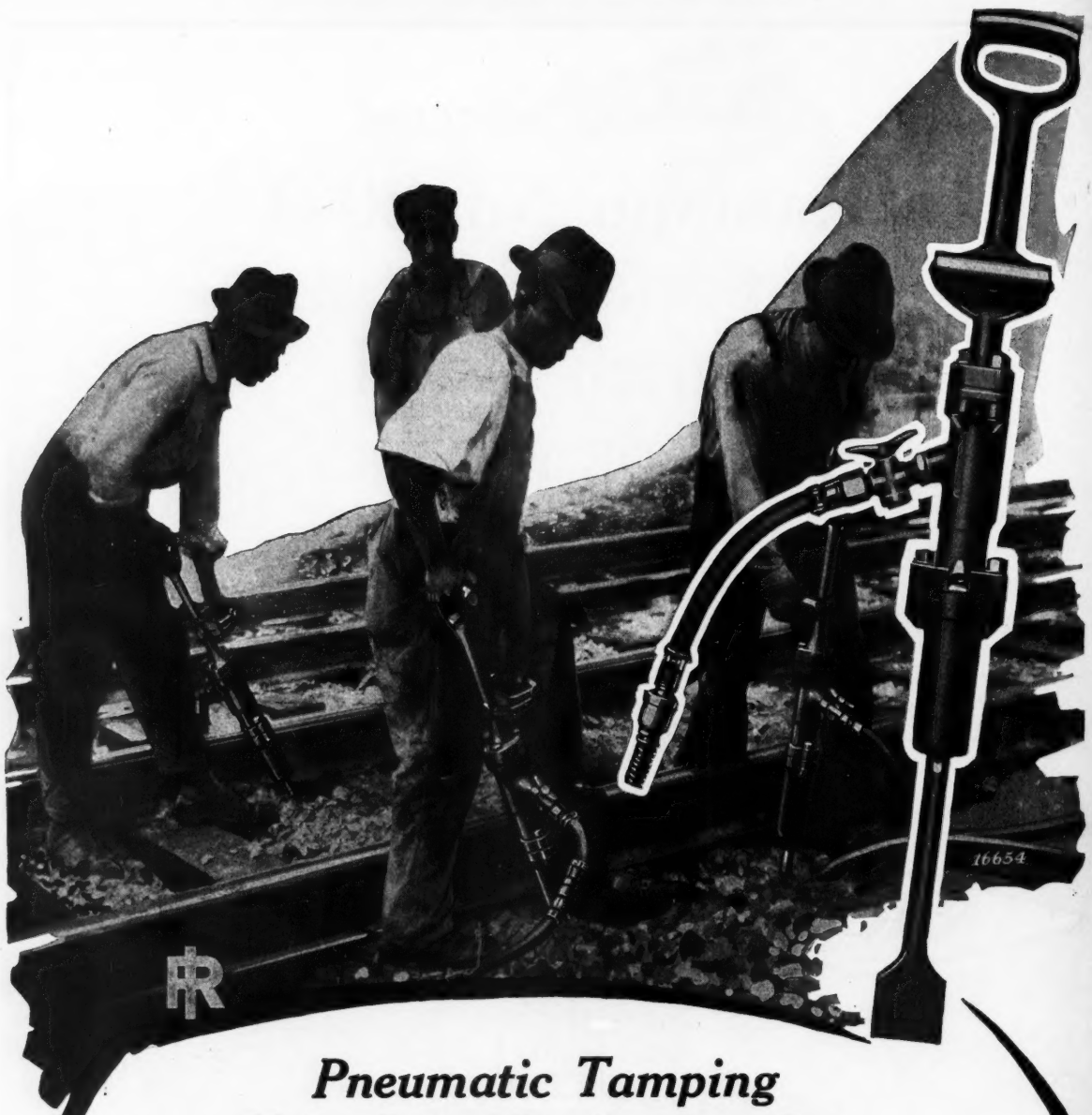

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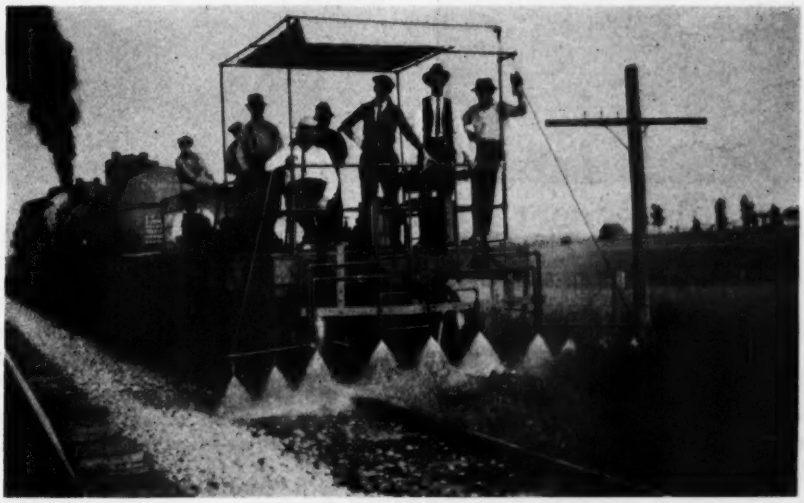
Cut Your Costs of TRACK WEEDING

by using



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The WEED EXTERMINATOR

"HERBICIDE" showed a 50 per cent saving on one road last year over the cost of handweeding.

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Write for our new booklet on Weed Killing. Gladly sent upon request.

Reade Manufacturing Co., Jersey City, N. J.

Works: Jersey City and Chicago

THE IDOL TRACK LINER

Illustration No. 1

Illustration No. 2

Illustrations numbers 1 and 2 show the lining of ordinary track. Set two Liners against outside rail in direction to be lined, and one against inside rail.

Illustration No. 1 shows three men doing the same work with Idol Track Liners as was formerly done by seven to nine men with lining bars. The seven men using lining bars shown in illustration number 2 could not line the track; the three men with Liners moved the same track easily, without digging out the ballast at the end of the ties. When section crews are reduced to three men, all ordinary track can be lined without waiting for the organization of full forces, and without the doubling of section crews.

Now in use on 51 railroads. The most practical and economical labor saving device for lining track ever invented. Saves at least 50% labor cost.

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Atchison, Topeka & Santa Fe
Baltimore & Ohio
Belt Railway of Chicago
Canadian National
Chicago & Illinois Midland
Chicago & Northwestern
Chicago & Western Indiana
Chicago, Burlington & Quincy
Chicago, Great Western
Chicago Junction
Chicago, Milwaukee & St. Paul
Chicago, Rock Island & Pacific
Chicago, St. Paul, Minneapolis & Omaha
Cleveland, Cincinnati, Chicago & St. Louis
Delaware & Hudson
Detroit & Toledo Shore Line
Elgin, Joliet & Eastern
Erie
Grand Trunk
Illinois Central
Kansas City Southern
Kansas City Terminal
Lehigh Valley
Long Island
Louisville & Nashville
Michigan Central
Middletown & Unionville
Minneapolis, St. Paul & Sault Ste. Marie
Missouri-Kansas-Texas
Missouri Pacific
Montour
Nashville, Chattanooga & St. Louis
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Nickel Plate
Northern Pacific
Pennsylvania
Pere Marquette
St. Louis-San Francisco
St. Louis Southern
San Antonio & Arkansas
Seaboard Air Line
Tennessee, Alabama & Georgia
Terminal Association of St. Louis
Union Belt of Detroit
Union Pacific System
Utah
Wabash
Waterloo, Cedar Falls & Northern
Western Maryland

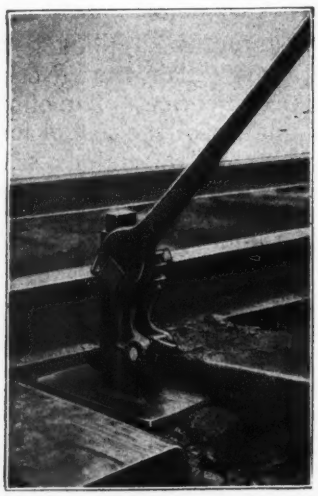

Illustration No. 3

IDOL TRACK JACK No. 1

Illustration No. 3 shows Idol Track Jack No. 1 in position to lift track with ordinary track wrench.

Illustration No. 4 shows man carrying Idol Track Jack, wrench, pick and shovel with ease.

This jack is made light enough to enable one man to raise low joints, space ties and surface track. It is made of all-steel in 5 parts. No railroad should be without them.

This jack has been scientifically tested in the laboratories of the Armour Institute of Technology, Chicago, Ill.

Idol Track Labor Saving Devices were the talk of the N. R. A. A. Exhibition.

Illustration No. 4

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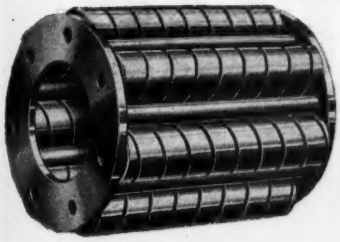

At the Show

If you attended the National Railway Appliance Show in Chicago, you probably saw the Hyatt roller bearing equipped railway maintenance cars built by these manufacturers.

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Fairbanks, Morse & Company . . . . . Chicago, Ill.
Fairmont Railway Motors, Inc., ... Fairmont, Minn.
Kalamazoo Railway Supply Company . . . . . Kalamazoo, Mich.
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Northwestern Motor Company . . . . . Eau Claire, Wis.

"Hyatt equipped" is one of the marks by which better maintenance cars are selected. Hyatt bearings in this equipment insure dependable, carefree operation without bearing trouble or its resulting annoyance and cost.

Specify them for economical upkeep and all around satisfactory car performance.

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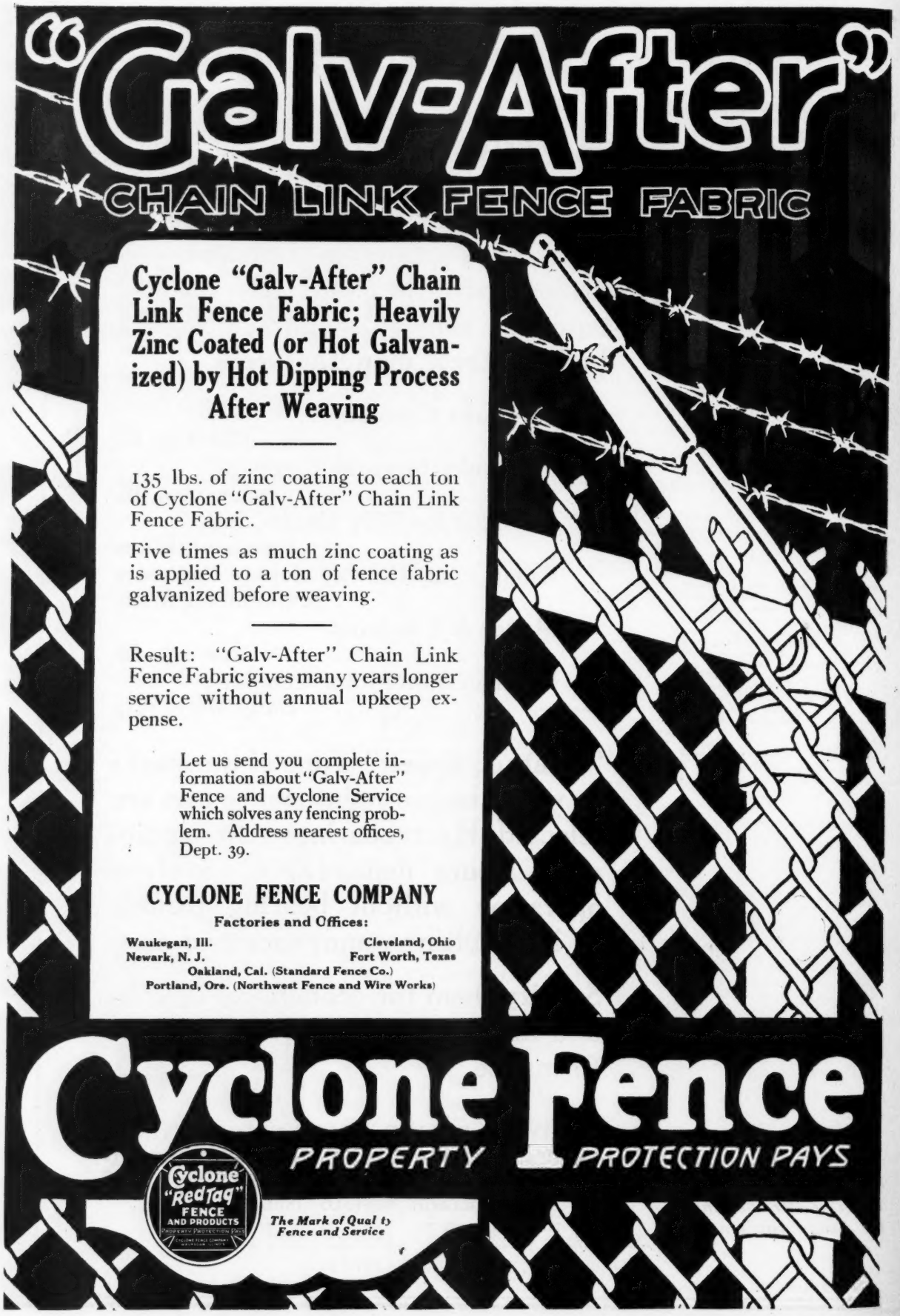
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CHAIN LINK FENCE FABRIC
Cyclone "Galv-After" Chain Link Fence Fabric; Heavily Zinc Coated (or Hot Galvanized) by Hot Dipping Process After Weaving
135 lbs. of zinc coating to each ton of Cyclone "Galv-After" Chain Link Fence Fabric.
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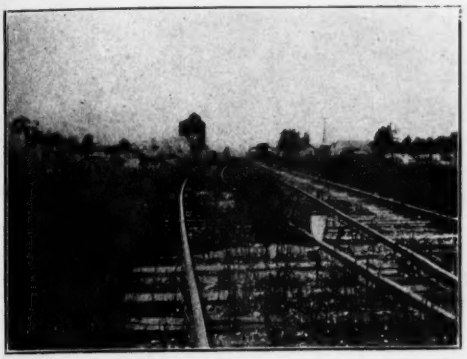
RAILROADS SPEND $5,000,000.00 FOR ATLAS "A" WEED KILLER



BEFORE

Here are two pictures of the same section taken before and after treatment with ATLAS "A"

AFTER

In our files are over 1,000 such comparative photographs taken on American Railroads from Maine to California and from Canada to Mexico.

We have successfully treated thousands of miles of track annually since 1911. Repeat orders reach us year after year, totaling over $5,000,000, the most convincing evidence of the value of our Service.

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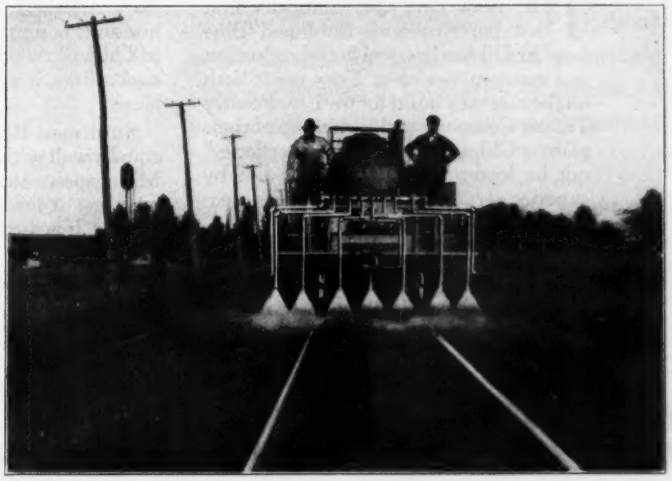

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Type "C" Spray Equipment especially designed for light growth or retreatment work

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Factories:

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Lowering Production and Maintenance Costs of Painting

THE New City Car Company find that painting with Sublimed Blue Lead in Oil has lowered both production and maintenance costs. They use it both on the cars they build for the Live Poultry Transit Company and for upkeep of their plant at Chicago. The economy is effected, not by lower price per pound, but by superior service in covering power, ease of application and durability.

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Widening and deepening Chesapeake and Delaware Canal near Summit Bridge where excavation is 100 feet deep

Mr. Wm. Oberly, Superintendent of dredging on Chesapeake and Delaware Canal Contract of W. H. Gahagan, Inc.

Where it paid to shoot dirt

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As a result of its 122 years' experience in the manufacture of explosives and constant study of their performance, the du Pont Company is enabled to supply the type of explosives best suited for any job—no matter how difficult.

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No. 5 of a Series

Name of Railway: C. G. W. R. R.

Location: Main line, Chicago to Omaha.

Traffic: Heavy freight and passenger.

Installation Data: A 12 ga., 36 in. ARMCO Culvert under 4 ft. fill of sandy soil. Installed 1910-11.

Condition: Excellent. Galvanizing evidently intact. No settlement. Inspected and photographed January 3, 1922.

Remarks: Inspection of culvert under comparatively light sandy fill of this nature when heavy train is passing reveals the need for an elastic structure at such a location.

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ARMCO Ingot Iron

ARMCO CULVERT & FLUME MFRS. ASS'N, 215 North Michigan Avenue, Chicago

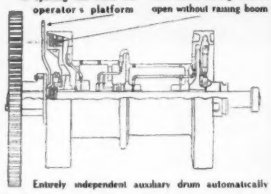
ARMCO CULVERTS

Why Industrials Excel

5 AUTOMATIC DOUBLE DRUMS

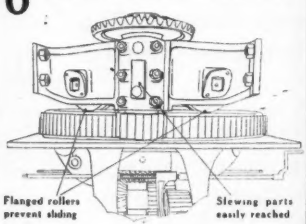
Lever regulates tension on opening line from the operator's platform

Speedy bucket work due to this clutch lifting bucket open without raising boom



Entirely independent auxiliary drum automatically controls bucket opening line without lever or power from other drum and gives two lines for erection or dragline service

6 POSITIVE SLEWING CONTROL



Flanged rollers prevent sliding

Slewing parts easily reached

Extra heavy gearing with external rack bolted rigidly to car body and efficient brake give absolute slewing control, allowing loads to be handled on grades and uneven tracks without danger of sudden rotation with its possible disastrous results

How do YOU clean ballast?

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Railway Pile Drivers -- Combination Crane Pile Drivers -- Transfer Tables
Portable Rail Saws -- Grab Buckets -- Magnets -- Steam Pile Hammers

INDUSTRIAL LOCOMOTIVE CRANES

Railway
Engineering and Maintenance

Volume 20 April, 1924 No. 4

CAN YOU USE THE WATCHMAN?

NO one will deny that crossing watchmen are necessary at nearly all points where they are employed. Some of them have an exceedingly busy and nerve-racking time of it all day long. Others have little or nothing to do for hours at a time. Of course, the crossing watchman's first duty is to guard the crossing, but it is an economic waste to maintain him in almost total idleness if it is possible to find him something to do that will not interfere with his principal responsibility.

Many watchmen have taken it upon themselves to find work for their hours of idleness. They frequently turn to gardening, and flower beds of fantastic design, bordered by whitewash pebbles, are the most common result of their efforts. But, while these men deserve commendation for their interest, it cannot be said that their work is bringing much of a return to the railroad. Flower beds are to be commended, but they do not compensate for an untidy right-of-way, loose planking in the crossing or other signs of slovenly maintenance.

One railroad is employing its crossing watchmen as highway crossing maintainers. This road, which has made considerable use of stone screenings for the roadways at highway crossings, provides the watchman with a shovel and a pile of screenings and requires him to apply additional material from time to time as required to keep the crossing in good repair. This, of course, represents the most legitimate auxiliary utilization of the watchman's time, as it keeps him strictly within the limits of his post of duty. Whether he can do more than this is problematical and depends, of course, on the density of traffic, the speed of the trains and the distance that they may be seen. But surely there are cases where it would be possible to impose other duties on the man at the crossing with perfect security. These could include the cleaning of ditches and drains, the cutting of weeds, the repairing of fences, etc., all within a short distance of the crossing. It is true that there are questions of discipline to be considered but proper study should point to some opportunity for the watchman to share in the work of the section gang.

IS MAINTENANCE OF WAY WORK SEASONAL?

IS maintenance of way work necessarily seasonal? If past practice is the criterion it is, for it has long been the custom to reduce forces to the minimum at the approach of winter and then to crowd the year's work into the summer season and frequently into the last half of it. No practice has added more to the cost of maintenance of way work than this, for it has prevented the building up of a permanent force, as the desirable man leaves at the first opportunity and only the inexperienced and the inefficient are available.

Admittedly, much maintenance work can be done better in summer, other things being equal. But other things are not equal, for this presumes as stable and efficient a force when organized on a summer basis as on an all-year-round basis, which is obviously incorrect. At least in the more northerly areas much work must of necessity be done in the summer. However, much other work can be done to approximately, if not entirely, the same advantage in the winter. As an instance, an officer who had long held the opinion that it was not practicable to maintain painting gangs during the winter made a check late last fall of the work which had been done during the preceding summer on the territory under his supervision. To his surprise he found that a sufficient amount of interior work had been handled in this way to have kept 40 per cent of the summer painting force busy all winter, thereby not only increasing the summer peak unduly, but working an in-

SPENDING $8,000 A MINUTE

The Class I railways of the United States (those with gross earnings of more than $1,000,000 annually) spent $821,380,876 for the maintenance of their tracks and structures during 1923 in addition to approximately $385,040,674 for improvements and additions to their roadway properties. On the basis of 300 working days of eight hours each this expenditure was at the rate of $4,000,000 per day, $500,000 per hour or $8,000 per minute. As approximately 54 cents of every dollar was expended in the form of wages for the more than 400,000 employees, the payroll expenditure alone was at the rate of more than $4,000 per minute. This indicates the magnitude of the operations of the maintenance of way department and the importance of directing every effort to secure the greatest possible return. It illustrates alike the possibilities of waste and the opportunities for economies. If each employee would save the equivalent of only 10 cents per day through the more careful use of his time and the material which he handles the savings will aggregate more than $12,000,000 in a year. No employee who is loyal to the company from which he receives his living can fail to recognize the obligation which he owes to his employer to so perform the duties which fall to his lot as to yield the greatest practicable return for his effort.

justice on the more capable employees by forcing them to seek other employment in the fall.

If such work as could be done equally or nearly as well in the winter could be held over until that time, in addition to keeping the minimum forces employed constructively, it would hold available for service those men who would otherwise have been laid off in the fall and thus lost to the railways. The loss in efficiency from the breaking in of new men each spring and the large turnover throughout the season induced by the temporary character of employment, costs the roads a large sum annually which would go far towards offsetting any lack of production because of adverse weather conditions during the winter.

This problem is becoming more pressing each year as the demand for men increases and the supply of surplus floating labor decreases. It deserves the careful study of maintenance officers, particularly at this season of the year when they are laying out their programs and when steps may be taken to postpone such work as may reasonably be held over until the fall and winter.

THE WORK TRAIN

THE work train is an established institution in the maintenance of way department. It has long been the accepted means of transportation and distribution of the many materials used in the upkeep of the tracks and structures. For many tasks it is a necessity, for others a convenience. Originating in a period when the locomotive was the only self-propelled power unit on the track, it has held its own all too well in competition with the motor car. With the rapidly rising costs of work train service, both direct as in wages and indirect through the growing delays because of heavier traffic, the charge per unit of work done has risen to the point where the development of other expedients is imperative in many instances. This has lead one road to use a 40-hp. motor car which, with a trailer, will haul 150 ties at a time. With a nominal cost of operatation and without the necessity for a train crew the cost of distributing materials has been reduced greatly by the use of this equipment. The time has come when precedent and habit should be discarded and each proposal for the use of a work train made to stand comparison with other means of transportation. Then after a train has been authorized the officer requesting it should be held responsible for the planning of its work to insure that it will be employed to the best advantage, for a facility which costs $75 to $100 a day must earn a large return to warrant its use.

A PROMISING DEVELOPMENT

ONE of the most promising indications that better days are coming in the railway industry has been the tendency in recent months toward the holding of friendly conferences of employers and employees for the consideration of their mutual problems and the determination of solutions satisfactory to both. In the mechanical department this has been evidenced most prominently in the program of co-operation which has been developed between the federated shop crafts and the management of the Baltimore & Ohio, and on which representatives of both are working in the development of more efficient methods.

No problem has affected employees of the maintenance of way department or the roads more adversely than that resulting from the wide fluctuations in forces between summer and winter. This practice has cost the roads large sums of money and has worked a hardship on the employees sufficient to drive many of them into other industries. In a letter to the editor which is published in another column, L. E. Keller, statistician of the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers, has called attention to this problem and has placed the resources of the brotherhood at the disposal of the railways in the development of a plan which will eliminate this practice, at least in part. In this letter he presents the case of the employee and urges the roads to give careful consideration to the problem. This is surely a subject which is of common interest to employer and employee and if, by mutual study and co-operation, they can arrive at a satisfactory solution, both will gain therefrom.

SCHEDULE THEIR TASKS

MUCH attention is now being given to the formulation of programs for the season's work. In general, this includes the development of rather detailed plans for the larger projects in order that men and materials may be available when needed. It is to be regretted that equal attention is not being given to the preparation of similar schedules for the more routine work handled by the section and other maintenance gangs, particularly in view of the large amount of money which is spent annually by these forces.

It may be considered at first thought that such attention is unnecessary because of the less complicated nature of the work of the smaller gangs. However, from at least one standpoint that problem is more difficult. The work of these forces may be divided between that which may be termed "patch work" and the more extensive repair and improvement jobs. Because of its nature the former must be watched carefully or it will consume practically all of the time of the forces. It is here that a program is beneficial.

If a supervisor will prepare a schedule of the work to be done on each section, preferably in conjunction with the foremen, and indicate the time at which each task should be done, the foremen will be able to plan further ahead and eliminate much lost motion. The result will be that a larger amount of constructive work will be done with the same force without extra effort or exertion. This has been demonstrated on several roads. It warrants general adoption. Now is the time to develop it.

WE ARE MAKING PROGRESS

IN no phase of maintenance of way has there been a more marked change in viewpoint during the last 15 years than in that relating to ties and their renewal. This transition has been one of necessity, the result of the growing scarcity of timber and the consequent increase in the cost of ties and the expense of placing them. It is not far wrong to say that the value of a tie in place is now three times what it was a decade and one-half ago. Thanks to the efforts of general officers in charge of maintenance, the rank and file of the departments are now rather generally aware of this greater cost of ties and appreciate fully the needs of conserving them and the value of timber treatment as a means to this end. It is not many years since roadmasters as a class were very much out of sympathy with timber preservation and were wont to express their attitude by the oft repeated remark "give me a good white oak tie." But that day has passed and convincing testimony of the prevailing thought among supervisory officers on the entire subject of ties is to be found in the article appearing on another page of this issue which reports the discussion of tie renewals at a recent meeting of the Maintenance of Way Club of Chicago. It will be clear from a reading of this that all of the speakers have a good working knowledge of the economics of cross-tie maintenance and renewals. This

represents encouraging progress, but it must be carried one step further. The foreman, also, must thoroughly understand the value of the ties in the track as well as those that are furnished them for renewals.

THE SUPERVISION OF TIE RENEWALS

EARLY in the current month the track forces on most of the roads in the United States and in Canada will enter actively on their season's tie renewal programs. More than 100,000,000 ties will be replaced within the next few months at a cost for labor and materials of over $200,000,000. One dollar of every six spent in the maintenance of tracks and structures goes for ties and the charges to this account are nearly four times those for rail. It should therefore be self evident that this expenditure warrants the most careful attention of maintenance officers of all ranks from chief engineer to division engineer, roadmaster and foreman.

In the conservation of this expenditure the first important step is, of course, to determine those ties which should be renewed. This calls for the exercise of judgment of a high order. While safety must be the first consideration and no tie should be left in track which will endanger traffic, every tie removed prematurely results in a loss of approximately 25 cents for each year's life so destroyed. The dating nail serves a useful purpose here as a check on the judgment of a foreman, causing him to think twice before removing a tie which has been in the track for less than the normal life. In an effort to promote uniformity of renewals and to curb alike, the tendencies of some foremen to remove ties prematurely, and of others to leave them in until the safety of track is endangered, some roadmasters personally assist their various foremen in selecting and spotting their ties for renewal. On other roads inspectors are employed for this purpose, while on still others the roadmasters or inspectors from the tie and timber department examine all ties removed from the track before they are destroyed to detect premature removals. The amount of money involved in the renewal of ties is sufficient to warrant every road and every roadmaster in taking such steps as will insure that the full life is secured from all ties before they are removed from the track, for after they have been taken out in error it is seldom advisable to re-insert them, at least in main tracks.

Another phase of this problem to which track men have given too little attention in the past has been the quality of the ties used in renewal. They have been prone to accept without comment those ties which have been furnished them, even though they have seen at times that they were inferior in quality and destined to give short life. The track men under whose supervision the ties are installed and who are responsible for maintenance costs, owe it to their roads to call attention in the proper manner and through the proper channels to any shortcomings in the character of the ties they are receiving and to urge changes in qualities and sizes which will increase the service sufficient to reduce the ultimate cost. If their contentions are correct, their comments will be valuable in raising the standards of the ties purchased.

Having decided what ties are to be renewed and having secured others of proper quality for replacement it becomes the problem of the track forces to make these renewals. Any operation which is repeated one hundred million times annually and perhaps two thousand times by a single gang in one season deserves careful study to insure that the most economical methods are pursued. Even the most casual study of the output of different gangs will requently show variations as great as 100 per cent in cost. It is evident that such conditions offer marked opportunities for the standardization of methods.

Letters to the Editor

THE PLACE TO STRAIGHTEN SPIKES

Amarillo, Tex.

To the Editor:

In the January, 1924, issue of *Railway Engineering and Maintenance*, page 23, several railway officers expressed their views on the proper place to straighten track spikes. My experience has been that the best way to handle reclaimed spikes is to have a spike shaper at some central point on each division and have all spikes during normal periods sent to this central point and straightened. Two men with this machine can straighten from 15 to 17 kegs of spikes per day. When relaying rail the spike shaper is carried by the extra gangs engaged in laying and surfacing the rail and the spikes are picked up daily, sorted and straightened on the job and re-used. This has been found to be a very satisfactory arrangement.

R. A. RUTLEDGE,
District Engineer, Atchison, Topeka & Santa Fe

SUPPLIES FOR MOTOR CARS

The Northwest,

To the Editor:

One of the discussions in the "What's the Answer" department of *Railway Engineering and Maintenance* for March was on the question as to how large a stock of parts foremen should carry for motor cars. I disagree most emphatically with Mr. J. J. Hess when he says that no motor car repairs are needed at section headquarters.

The motor car maintainer may be at the other end of the district when the car needs repair. My experience is that it takes several days to get him and if you want to get the car going it is necessary to fix it yourself, except where major repairs are required. When you have 12 miles of main line you need to look over some part of your track pretty nearly every day and you have no time to wait for the maintainer. It would be well for roadmasters to have an extra car that could be sent to the point where foreman is in trouble, but since this is not the case, I see to it that I have a number of small repair parts on hand all the time, as most everybody does.

OLD TIMER.

AN OPPORTUNITY FOR CO-OPERATION

Detroit, Mich.

To the Editor:

With the approach of winter the wage earner always faces a serious problem, with the high price of coal, better and heavier clothing, the loss of a garden, etc. The worker who realizes that the first snow means a force reduction and probable loss of employment has an especially serious problem, particularly when he has not been able to save a few dollars from his summer earnings. On the other hand, with maintenance of way expenses in excess of half a billion dollars a year, the railroads face a problem that is by no means insignificant and one sufficient to justify their desire for a dollar's worth of work performed for every dollar paid out.

It has long been the claim of those responsible for the efficient and economical maintenance of railroad tracks, bridges and structures that work cannot be performed as well or as economically in the winter. To question the accuracy of this opinion will probably result in a storm of criticism or perhaps those at first tempted to criticize will decide, on further thought, that questioning this long practice is the result of a disturbed brain and think of the

questioner sympathetically. Nevertheless, I do question the economy and efficiency of drastic winter force reduction in the maintenance of way department. In doing so I hasten to admit that frozen track cannot be surfaced, retimbered and lined as well as can be done in spring and summer. In fact, I know from practical experience that it is not economical to attempt the performance of this class of work in severe weather. But track is not frozen all winter. In the north it may be most of the winter but in the south it probably is not frozen at all. Yet the winter force reduction is general, as may be noted from the Interstate Commerce Commission's statistics on the number of employees in service in July as compared with January.

However, the track gang need not be engaged in line and surface work all the time, and this introduces the point I wish to make. Any foreman, supervisor or roadmaster will tell you that when spring opens up and he should be free to jump into his summer work, he is confronted with a lot of other work that should, or at least, could have been done just as well in the winter. The foreman is also confronted with the usual "spring epidemic" of "green men"—men who have had little or no previous experience in maintenance of way work and who have little hope of staying regularly on the job. They have either heard of or experienced the irregularity of employment in this department and in many instances are not inclined to overdo themselves during their brief term of employment.

Much Said but Little Done

Let us first consider whether or not there is enough winter work to justify retaining more men in the service, and if so, whether it can be performed in a way to justify doing the work at that time of the year. This presents a question somewhat similar to Mark Twain's view of the weather. Much has been said about it, but very little has been done about it.

Ties can be distributed as well, if not better, in the winter and will then be where needed when spring work is begun. Track can be gaged and should be put to gage before starting spring work. Fences can be repaired, broken or defective angle bars and rails replaced, bolts tightened, spikes driven down, private and public road crossings repaired, defective frogs and switches repaired or replaced, right-of-way cleaned and scrap and rubbish removed, cuts sloped and ditches cleaned when ground is not severely frozen, soft places in track and fills "riprapped," tracks shimmed, ties adzed on curves and turnouts where rail is turning in, etc. In addition to this kind of work there is always track to be smoothed, sometimes snow and ice to be cleaned away from switches and platforms, and usually a good bit of other work that can be done even though it does not necessarily demand immediate attention. If the foreman is not furnished men for the foregoing work in winter he is compelled to do most of it in the spring and summer when he should be busily engaged in rebuilding his tracks and using to best advantage the new ties, rail and ballast allotted his section.

But there are other important sides to the force reduction question that will, I think, offset the argument that work is not economically performed in cold weather "when the men stand first on one foot, then on the other, beating their hands together to keep warm." If an employee possesses the qualifications necessary to make him a desirable employee and one who appears to have the characteristics of a future foreman, he will, by these same qualifications, think twice before accepting employment with the prospects of being thrown out of work when the snow flies and when a job is most needed. Regularity of employment is important to him just as is the question of wages. Unless a good class of men enter the service the management will see its problem of future foremen becoming more and more serious. How are men of this qualification to be attracted to a job that is only seasonal? Each spring finds good track men settled in other jobs and unwilling to take up track work for the summer because they know only too well "the ax will fall" when the first snow falls. And each spring finds an accumulation of work left undone during the winter that must be taken care of along with the large quantity of work which can only be done in summer.

If a sufficient number of first-class men were willing to take summer jobs the practice of winter force reduction would not be so bad, but such is not the case, as everybody closely connected with the work knows. The railroad's "employee investment" would pay far greater dividends if better men could be attracted with reasonable assurance of steady employment.

In fact, the benefits of continuous year-round employment would be twofold to the management because it would not only attract better men but would also enable the better class of employees to acquire more skill and experience and consequently would result in more efficient and economical performance of work. Thus, with better men in the gangs, with winter work taken care of as it develops and with the foreman permitted to do his summer work without having a dozen other things to do that should be already done, such as distributing ties and rails and stopping his regular work for this or that, it would be found that more and better work could be accomplished in the spring and summer with fewer men and the increased cost of more winter employees would probably be more than offset; perhaps not offset entirely by the actual number of men for the entire year, but by output per man per year and by the rule of a dollar's worth of work for a dollar's pay in wages. I believe that fewer continuous men of a better class would do more and better work than a greater yearly total of irregular inexperienced men.

Another material benefit of a more regular force lies in increased safety. Experienced men are not as apt to injure themselves or others; motor cars could be operated more safely and with less danger of loss of life and property through collisions; obstructions of track could be removed more quickly and guarded more safely by a strict compliance with flagging rules, something that is impossible with less than two men at the very least; and a general reduction of traffic delay, personal injury and property damage would result. Savings in this respect would be difficult to estimate but it is not unreasonable to say that savings would result.

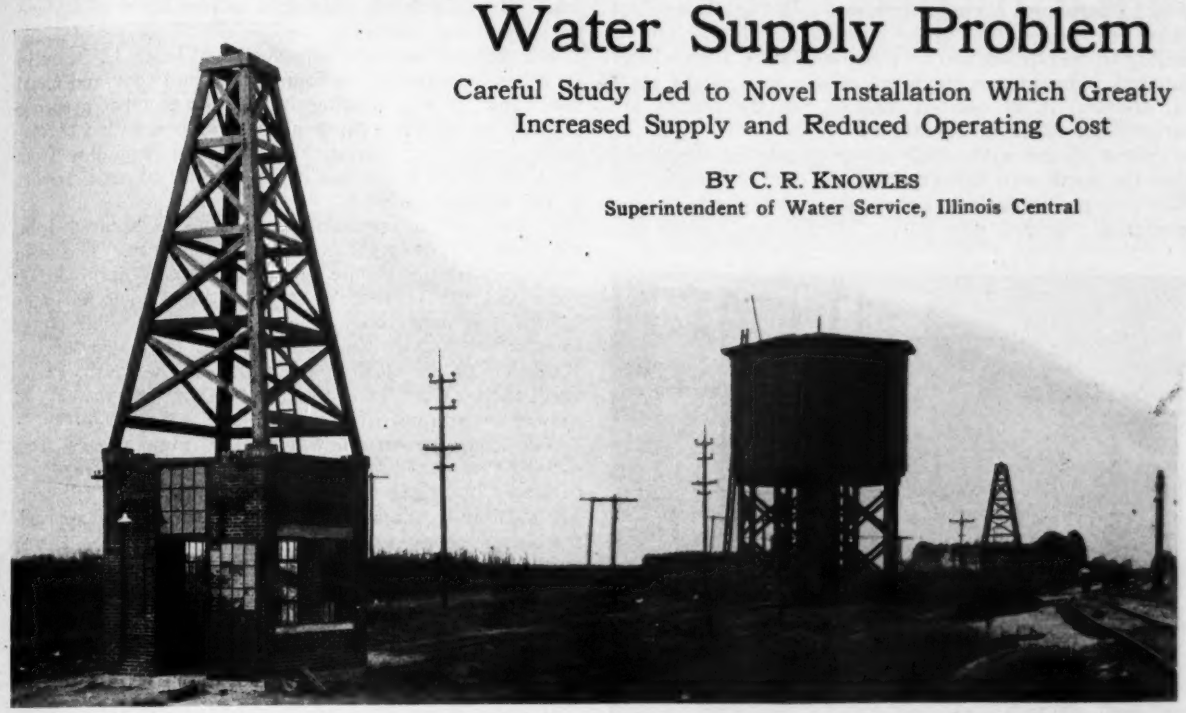
The United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers is interested in the welfare of the railroads because the railroads are a vitally necessary industry and particularly because the brotherhood represents the large army of maintenance of way employees in the United States and Canada. If our department of the industry can be made more efficient and economical we can hope for better industrial conditions for those whom we represent. If we can be of any assistance in establishing a greater degree of efficiency and economy we can expect to share in the savings through improved wages. It is, therefore, suggested that the question of winter force reduction be given consideration and the maintenance of way employees' organization extends its service to any road, or group of roads, that thinks there are grounds for improvement in this connection.

L. E. KELLER,
Statistician, United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers.

Construction of Gravel Wall Wells Solves Water Supply Problem

Careful Study Led to Novel Installation Which Greatly Increased Supply and Reduced Operating Cost

By C. R. Knowles
Superintendent of Water Service, Illinois Central



The Two Pump Houses and the Tank at Paxton, Ill.

THE Illinois Central has recently completed a new water station at Paxton, Illinois, that has apparently solved a long standing problem of securing an adequate supply of water at this point. The new facilities include two deep wells with motor-driven pumps of the vertical turbine type, brick pump houses, a 100,000 gal. water tank and 12-in. water columns.

Paxton is 103 miles south of Chicago on the Illinois division and is a desirable location for a water station from an operating standpoint on account of the convenient spacing between water stations on either side. It has been established as a water station for many years but the supply of water has been very limited and trains were under almost constant restrictions as to the quantity of water taken prior to the construction of the new station.

Grade reduction and the separation of grades through Paxton last year made it necessary to relocate the water station about two miles north of Paxton where new passing tracks have been constructed, and in selecting the new location an investigation was made with a view of securing a larger supply. There are no dependable surface supplies in this vicinity and the topography of the country is such that no reservoir location was available and it was impractical to impound a sufficient supply. Therefore, the only recourse was to secure a supply from wells.

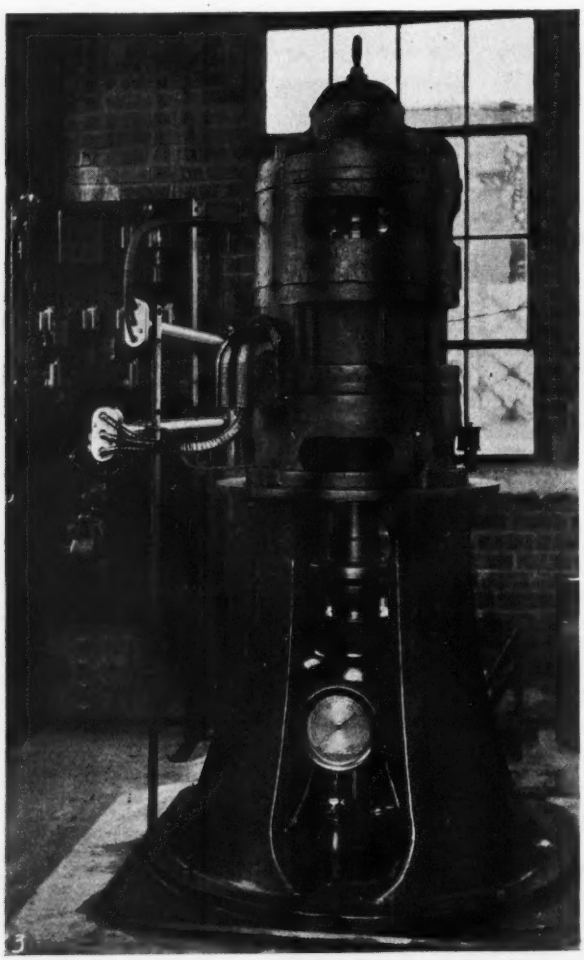
The geological formation in the vicinity of Paxton consists of an almost continuous sheet of blue till, 100 ft. or more in depth, beneath which is a series of hard till deposits embedded with sand and gravel containing some water. The supply of water at the old station was secured from three wells 10-in. in diameter and from 120 to 142 ft. in depth, the yield from each well being only 40 to 50 gal. per minute. It was realized that if ground water was to be depended upon it would be necessary to construct wells of a different type and greater capacity than the existing wells.

Test holes were drilled to determine the exact location and extent of the water-bearing formations before the type and size of well was decided upon. Hard pan was found at a depth of about 150 ft. and although the test borings were carried down 350 ft. no favorable indications of water were found below the hard pan. The formation immediately above the hard pan was packed sand with indications of considerable water. It was therefore decided to install gravel wall wells of large diameter. Two holes 26 in. in diameter were drilled down to hard pan, the south well being 147 ft. deep and the north well 149 ft. deep. These holes were cased from the surface to the top of the waterbearing formation with steel casing of the full diameter of the hole. A second casing consisting of 111 ft. of solid casing and 38 ft. of shutter screen 16-in. in diameter, extending down to the hard pan, was placed inside of the 26-in. casing, the screen being placed in the water-bearing formation. Gravel was then fed into the space between the two casings and a test pump placed in the well to develop the water-bearing formation. The test pump brought out large quantities of sand with the water and as the sand was pumped out gravel was fed into the top between the two strings of casing, this gravel replacing the sand as it was removed and forming a gravel wall about the screen. About twelve cubic yards of gravel was fed into each well. When the wells cleared up and would take no more gravel the test pump was removed and the permanent pump was installed.

Two 14-in., 5-stage, vertical, turbine pumps were installed, the pumps being identical with the exception that the pump in the north well is set slightly deeper than that in the south well. Each pump is driven by a 30 hp. 2300 volt vertical synchronous motor, direct-connected to the

pump by a vertical shaft. Each pump is equipped with a control panel carrying "overload" and "no-load" protection. The pumps are operated automatically, the control being adjusted so that in the event of one of the pumps failing to operate the second pump will start after a brief interval. One man is employed to take care of the plant on account of its isolated location but the pumps are strictly automatic in operation.

A test of the wells made upon completion developed that the north well delivered 361 gal. and the south well 326 gal. per minute into the tank, while both pumps, operating together, will deliver 530 gal. per minute into



The Equipment in the Two Pump Houses Is Identical

the tank. The decreased capacity of the two pumps operating together as compared to the combined capacity of the pumps operating singly is due partly to the increased friction head on the discharge line and partly to a slight drop in voltage when both pumps are being operated. It is rarely necessary to operate both pumps, as under ordinary operating conditions one pump will provide the supply satisfactorily, the second well having been installed as a standby unit as well as to take care of exceptionally heavy demands.

The automatic control features are handled by float switches located in the tank. These switches are so adjusted that pump No. 1 starts and stops with a variation of 3 ft. of water in the tank. In the event that pump No. 1 does not maintain the supply, pump No. 2 will start after a further reduction of a 2-ft. head in the tank and in turn will stop 2 ft. ahead of pump No. 1. This float switch arrangement is so designed that pump No. 1 and pump No. 2 may be alternated as the main pump and helper pump at intervals.

The pump houses are constructed of brick 12 ft. by 14 ft. in size, with concrete foundations and roof and metal sash and doors, making them completely fireproof throughout. Each pump house is equipped with a permanent derrick for raising the pump and drop line from the wells in the event that it is necessary to make repairs to the wells or pumps.

Electricity for operating the pumps is secured from the Central Illinois Public Service Company. The main feed lines of the Public Service Company carry 33,000 volts and the current is stepped down to 2,300 volts before it is delivered to the pump motors. The power lines of the Service Company are fed from two sources, Kankakee on the north and Mattoon on the south. Therefore, there is but little likelihood of an interruption to service on account of power failure.

The consumption of water at Paxton ranges from 4,500,000 to 5,000,000 gal. per month. The average cost of water including all charges is approximately 6 cents per thousand gallons, as compared to a cost of approximately 18 cents per thousand gallons with the former station. While the annual operating cost of the new station is about the same as the cost of operating the old station the new station is pumping approximately three times the amount of water afforded by the old facilities and operating conditions have been materially improved through providing an ample supply of water at Paxton. The water is delivered into a standard 100,000 gal. creosoted tank and delivered to locomotives through 12 in. telescopic-type water columns conveniently located to serve both the north and southbound main tracks as well as the northbound and southbound passing tracks at that point.

The tank, pump house and pipe lines, were built by James & Shinn, Mattoon, Ill. The pumps, wells and well equipment, were furnished and installed by the Layne & Bowler Company, Chicago.

Railway Reservoirs Often Add Beauty to the Landscape

Getting the Maximum Service from Rail*

How One Officer has Analyzed the Various Factors That Determine When Rail Must be Replaced

By B. M. CHENEY
General Inspector of Permanent Way and Structures, Chicago, Burlington & Quincy

IN A STATEMENT showing the weighted average age of rail in those main lines of 13 western railroads on which it is the practice to lay new rail in renewals, it was found that the average age varied from 5.6 to 13.6 years. The Burlington was tenth on the list with an average of 9 years. This statement naturally raises some inquiries as to the reason for such a wide variation and some of the questions that will have to be answered are as follows:

1. What is the average weight of rail on the various lines?
2. What is the traffic density of each sub-division?
3. What is the relative amount of curved and tangent track?
4. How do the grades compare?
5. How do relay operations for the past 20 years compare?
6. How does the cost of track maintenance per mile compare?
7. What is the relative condition of rail released?
8. How do track conditions compare?
9. What class of motive power is used and what is the prevailing speed,

After this analysis has been completed a corresponding study will have to be made of those lines on which it is the practice to lay second-hand or relayer rail because the rail for these lines must come from main line renewals. If some important or heavy traffic branch lines are classed as second-hand rail territory, then the policy governing renewals in new rail territory may be quite different from that on some other road where branch lines of such importance would be included in new rail territory.

Rail Renewal Cycles

In 1909 and 1910, Road "A," which heads the list referred to, with an average age of 13.6 years, was applying new rail in 3,340 miles of main track. During those two years alone, it relaid 1,230 miles, which represented 35 per cent of the new rail territory. It seems probable that it may now be at the bottom of its rail-renewal cycle and that heavier renewal programs during the next five years may materially reduce the average age of its rail.

The reverse seems to be the case with road "M," at the bottom of the list, with an average rail age of 5.6 years. Its new rail territory involves 3,940 miles of track. In 1909 and 1910 it relaid only 278 miles or 7 per cent. For the past five years, however, its relay has averaged 435 miles per year. So it seems to be at the top of its relay-cycle where the average age of rail in track would be lowest. Furthermore, its traffic density is much greater than that of road "A."

As to the Burlington, in tenth place—our relaying from 1903 to 1914 averaged 486 miles per year. During the five years, 1906-1910, we laid 3,045 miles of new rail, an average of 609 miles per year. We were, during that period, replacing 75-lb. rail in our principal main lines with heavier sections. Our new-rail relay territory now amounts to 4,600 track miles. The average mileage relaid for the 10 years, 1916 to 1924, was 256 miles per year. On the basis of 4,600 miles involved, an average of life of 18 years might be indicated. The average age of rail renewed in 1923 was 13.3 years, while in 1924 the average age of rail to be removed is 15.2 years.

We are taking care of 5,000 miles of branch lines with relayer rail. One of these, a coal line, involving 450 track miles, part of which is still single track, carries from 50 to 60 million gross tons per year. In the double-track territory of that line, the northward track carries from 35 to 45 million gross tons annually. Relayer rail applied to such lines must be in pretty good condition and we are, therefore, obliged at times to relay some rail in our principal main lines which might, otherwise, be carried several years longer.

Attention is directed to this for the purpose of emphasizing at the start, the fact that there are many angles to the question of rail relaying, and unless some limitations are prescribed and some things assumed to be true, a discussion of the subject might be endless.

Rail Must Be Used As Long As Possible

In discussing means for prolonging the life of rail in track, we will assume at the start that it is good practice and economical to carry rail in track as long as is consistent with safety and with the standard of track maintenance prescribed for the particular line involved. The discussion is limited also to those main lines on which it is generally the practice to lay new rail, although the principles governing in relaying with new rail may be applied to a large extent to rail renewals with second-hand rail in branch lines and side tracks.

Rail-relaying programs submitted by roadmasters or supervisors are often radically reduced by general officers. These cuts are disappointing to the local officers and particularly the section foreman directly affected. So, first, let us consider the section foreman.

What Does the Foreman Think?

Take the case of the average foreman who takes real interest in his section. Let us suppose he has a stretch of 85 or 90-lb, rail that has been in track 12 years. This rail connects at one or both ends with 100 or 110-lb. rail. Perhaps it has not been surfaced out-of-face for 6 or 8 years, the joints are worn and can't be kept tight, the track is very hard to keep up. Last year he asked that it be relaid but was persuaded to carry it another year.

He can hardly wait for the following spring to come when the work train will appear to unload the rail and fittings. He hopes an extra gang will arrive as soon as the material is on the ground, and speculates as to the time it will take the gang to lay the rail and move on, leaving him alone with his new track.

Imagine, if you can, the feelings of such a foreman when he is informed along in February or March that it has been decided to replace only the worn-out joints with new and carry the rail several years longer. Not having had any information as to such measures or the need for them, would it be surprising if he threw up his hand and exclaimed—"What's the use?"

The foreman is human—his life-work is track, and if he can be shown that his efficiency is to be measured by

*Abstract of a paper and report of the discussion presented before the Maintenance of Way Club of Chicago on February 13.

the ability he displays in maintaining good track at the lowest possible cost in material as well as labor, the problem is almost solved. To accomplish this, it is necessary that he should know *why* the longest possible service must be obtained from material. He should be told *how* material can be conserved. It should be explained to him that there is much rail on the district or the system that is a great deal worse than his. He should be assured that he will get more credit for maintaining *fair* riding track on that old rail than he would for smoother track laid with new rail.

Therefore, the first and most important measure to insure the greatest life from rail and fittings is to inspire and develop the enthusiasm and interest of the section foreman. If it already exists, encourage it—if it doesn't exist, try to develop it.

The Supervisory Officer

When a roadmaster or supervisor prepares his recommendations for the relaying of rail, he has in mind only his own territory. If it happens that the rail in a large part of his track is in good condition, a stretch or stretches that are not so good may be put in his program, regardless of the fact that it has not reached the stage that puts the track below the standard expected for that particular line.

Safety, of course, must be the first consideration. Human lives are at stake and a large factor of safety must be allowed. Rail should never be allowed to reach a point where it is unsafe. There may be rail that, in the judgment of the roadmaster or supervisor, will reach the unsafe stage if not relaid during the following season. Such rail must be included on the program. But aside from rail which is approaching the limit of wear, the roadmaster and supervisor must also consider stretches that are battered—stretches in which there have been an excessive number of failures of one type or another, and finally he must say where in his judgment rail should be replaced with heavier pattern to promote economical maintenance.

On a line where rail is gradually being replaced with rail of heavier pattern, it frequently develops that a stretch of the lighter section connects at each end with the heavier rail. When riding over the line, the sudden change from smooth riding, unbattered, heavy rail to the somewhat rougher and considerably noisier, lighter rail, is apt to get on the nerves of the roadmaster. His nerves may be further taxed at times when his superior officers turn to him and ask, "What's the matter with this track?" That stretch of track is pretty sure to be recommended for relay, yet possibly the rail is in much better condition than long stretches of similar rail on the same line where the question of relay has not been raised.

In the final analysis, any rail relay program must be based, to a large extent, on a general policy which is governed somewhat by the prosperity of the railroad involved. When business is poor, rigid economy is required and standards for track must, therefore, fluctuate. This means that in dull times the pound of battered joints will be more noticeable than at times when business is good.

In conclusion, as a second means of prolonging the life of rail, roadmasters and supervisors should be informed as to the general policy and kept in touch with the ups and downs of revenue. They should be given opportunity to familiarize themselves with conditions and standards on other parts of their own road and occasionally visit other roads. They will then be able to harmonize *their* programs with the program as a whole.

Before considering the direct means of prolonging rail life it is well to list the reasons commonly given for renewing rail:

(1) Worn rail in straight track.
(2) Worn rail in curved track.
(3) Battered rail ends.
(4) Wheel-burnt rail.
(5) Surface or line-bent rail.
(6) Excessive rail failures.
(7) Rail too light for traffic handled.
(8) Damaged rail.

Worn Rail in Tangent Track

When is rail ripe for relay? Can any definite measure be set? Should it be taken out of this track when wear has reduced the height ⅛ in. and out of that track when reduced ¼ in? Or should it be left in track, other conditions being favorable, until the wheel flanges begin to ride the angle bars? Or would, say ten years' service justify removal from this track—15 years from that track, etc., making years of service the measure? Or would this rail be ripe because it has carried 100,000,000 tons, while that is ripe because it has carried 150,000,000 tons. Personally, I wouldn't want to suggest any definite rules for determining when rail is ripe. Conditions are too variable.

There are many cases where rail has been in track 25 to 50 per cent longer than other rail under like conditions and yet rides better than the younger rail. So age is a poor criterion. The gross tons carried may be just as deceptive as age for a given tonnage moving at 15 miles per hour has a different effect than the same tonnage moving at 35 miles per hour. The gross tons may be hauled this year by motive power that is easy on rail compared with motive power used next year.

In general, therefore, the section foreman and roadmaster should be first to observe that rail is approaching the limit of wear, whether it be from the standpoint of safety or of economical maintenance. The wear of rail in straight track may be minimized by keeping track to proper gage and in good surface and line.

When Is Rail Worn Out on Curves?

The stresses in rail on curves are much greater than in tangent track and a correspondingly greater factor of safety should be allowed. But the fact that rail in curves must be relaid is no argument for relaying the adjacent tangents.

It is now rather general practice to move the high rail over to the low side before it is too badly worn. This lengthens the average life of rail on curves. Proper adjustment of superelevation is another measure that may add materially to rail life. In recent years some roads have made radical changes in their rules governing superelevation and have obtained gratifying results. Special rails, such as manganese, titanium and Sandberg sorbitic, have given good results on sharp curves where rail wear is rapid, while on some roads, rails of heavier section are used on curves to equalize the relay periods with those of the adjacent tangents.

Battered Rail—Bad Joints

Bad joints and battered rail ends usually go hand in hand, and as these have comprised a major cause for relaying on the Burlington, in the past, an outline of our experience is pertinent. Previous to 1915, the requirements for heavier rail on branch lines were met by heavy programs of relaying on the principal main tracks, as it seemed more economical and desirable to do this than to buy new rail of lighter section for the branch lines. Since 1915, the policy has been to relay only such main line rail as is necessary, and has led, therefore, to studies of ways and means to prolong the life of rail which

resulted in the following findings and recommendations which were submitted to the operating vice president, with supporting data in about the order listed:

(a) It was found that a considerable mileage of main track will be carried in track several years longer by replacing worn-out joints with new. The joints were found to be worn-out on hundreds of miles of track. They were worn to such an extent as to come in contact with the web of the rail, while the top of the bar had little or no contact with the fishing surface of the head. The joint was, therefore, not much better than the old fish-plate. The replacement of worn-out joints was recommended for all rail that could be carried three or more years after such change.

(b) It was found also that heat-treated bars should be used in tracks carrying heavy wheel-loads and increased traffic, to eliminate breakage and to minimize wear. The breakage of the untreated bars was on the increase, many of them were bent and the rapid wear was evidenced in hundreds of miles of track.

(c) It was found that the untreated bolts were stretching, making it impossible to keep joints tight. The quantity of bolts required for replacement had increased enormously. The use of heat-treated bolts was therefore recommended.

(d) It was found that even with heat-treated bars and bolts, mechanical wear still took place to an extent that made frequent bolt-tightening necessary if joints were to be kept tight. To compensate for this looseness and thus minimize the amount of labor required for bolt-tightening, the replacement of the ordinary coil-nutlock by a high tension steel spring was also recommended. These springs deliver high pressure through a sufficient range to compensate for looseness amounting to 2¾ turns of the nut.

(e) On many joints the bond-wires had become wedged between the top of the bar and the web of the rail. This, of course, prevented proper tightening of the joint and was the cause of many worn bars. So it was recommended that bond wires, in future, be run around the outside rather than back of the joint.

(f) It was found that rail ends that are not too badly battered may be welded in track successfully and it was recommended that this practice be followed when in the judgment of our maintenance engineers, the life of the rail would be sufficiently prolonged to justify the expense of welding.

(g) It was further recommended that joints and joint maintenance be given more attention by section foremen and roadmasters.

These recommendations, of course, were not all submitted at one time. The investigations and the preparation of supporting data took time, but the suggestions were all approved eventually and put into effect. For example, in the last five years we have renewed worn angle-bars in 1,250 miles of track. We have been authorized to use heat-treated bars and bolts and to substitute high tension springs for nutlocks. Our bond wires are now being kept outside the joint, and roadmasters and section foremen are giving much more attention to joint maintenance. The results to date indicate that we are going to get from 40 to 50 per cent greater service from our rail than we could hope to get if these measures had not been applied.

Miscellaneous Problems

The only means found to overcome wheel burning is to appeal to enginemen. We know that much of this damage can be materially reduced if they will try. The motive power department can help by keeping a record of the sand left in the sand-domes of engines arriving at terminals to determine if the engines may have moved over part of their runs without sand.

Surface-bent rail may often be prevented if taken in time, but like rail creepage, it usually develops very slowly and may not be noticed until too late. Vigilant inspection and prompt surfacing seem to be the only remedy. Line bent rail caused by defective equipment is, of course, not the fault of the foreman but a prompt report on his part may prevent further damage.

Sufficient anchors must be applied to hold the rail. Anchorage that holds the rail this year may be insufficient next year. Constant vigilance is necessary to detect the first symptons of creepage, and when detected the proper remedy should be applied without delay.

Excessive rail failures may be an advance notice of excessive wear, in which case the stretch of track involved must be relaid. They may be due to some poor steel which, of course, would justify relaying, or they may be caused by improper counterbalance of some engine driver, in which case the rails actually broken must be replaced and careful watch kept of the remainder of the rail over which the defective engine has passed.

When Is Rail Too Light for the Traffic?

The question of light rail is sometimes difficult to answer. Each case must be considered on its merits. The foreman and roadmaster, however, have their fingers on the pulse of the patient and should be the first to call attention to symptons that seem to warrant heavier rail. Their opinions, however, may not have much weight unless supported by some tangible evidence. So when they begin to feel that heavier rail is justified, they should start keeping a record of maintenance costs of track laid with heavier rail, as well as the track laid with a lighter rail.

Damaged Rail

The amount of rail damaged by broken wheels or derailments often runs into very high figures. In the case of a broken wheel, the damage is clearly due to defective equipment. But the derailment may be due to a broken rail, poor track or defective equipment. In many cases, proper inspection of track or equipment and prompt application of corrective measures would have prevented the derailment. But how can the damage be minimized? In some cases rather than relay the rail, it is perfectly safe and more economical to apply angle-bars where nicks occur and leave the rail in track. Nicks on the head of the rail, if not too serious, may be welded. At any rate, unless the rail has about reached the relay stage, any safe measure that will avoid relay should be applied.

On certain lines carrying heavy refrigerator traffic, the life of rail is materially shortened by reason of the ravages of refrigerator brine. On the Burlington there are 818 miles of such track. To counteract the effects of brine we go over this track at least once a year with a Neafie oiling machine which sprays the web and flange of the rail as well as joints, tie plates, spikes and rail anchors with a coating of oil having an asphalt base. The results obtained from this treatment have been gratifying.

In Conclusion

Summarizing the points presented as means for prolonging the life of rail:

1. Develop the interest of section foremen.
2. Broaden the knowledge of roadmasters as to policy, revenue and outside conditions.
3. Keep track in good line and surface.
4. So far as is consistent with safety, adjust superelevation on curves to minimize wear.
5. Move the high rail on curves to the low side.
6. Use special or heavier rail on curves where the results will justify.
7. Replace worn-out joints with new.
8. Use heat-treated bars and bolts.
9. Use high tension instead of low tension springs or nutlocks.
10. Keep bond wires from behind the joint.
11. Weld battered rail-ends when the saving will justify.
12. Keep track bolts tight.
13. Ask enginemen to spare the rail from wheel burn.
14. Keep the track securely anchored.
15. Replace light rail with heavier sections when economical.
16. Inspect track and equipment frequently.
17. Spray with oil, all rail subjected to the ravages of refrigerator brine.

All of these measures are being applied on some roads, and some of them on all roads. Conditions on the various roads often differ widely, but if there is one measure among these mentioned that does apply to all roads, it is that of keeping track bolts tight.

Safety-first slogans have reduced accidents, fuel saving slogans have saved coal, freight-claim slogans have reduced claims. So there seems to be no reason why a few slogans for the track department might not serve equally well to effect savings by keeping up interest that would otherwise lag. And as a starter, the following is suggested:

"Tight Bolts Save Rail!"

"Are Your Bolts Tight?"

Discussion

C. W. Gennet, Jr., manager of the rail inspection department of the Robert W. Hunt Co., Chicago, suggested that one factor which was of vital importance in connection with any efforts to secure the maximum life of rail in track concerned the quality of the new rail inserted.

"There is a tremendous difference," he said, "in the quality of the rail delivered, yet the railroads as a whole make little effort to segregate the different heats and in almost no cases are the inferior rails from the top of the ingot separated from the better rails obtained from the lower portions. Much better results would be obtained if rails were segregated on the basis of the relative hardness, particularly in using the harder rails on curves. Much is to be gained also," he contended, "by the exercise of special pains in laying the rail and in keeping the joints tight."

C. W. Baldridge, general rail inspector, Atchison, Topeka & Santa Fe, Chicago, said that much confusion has occurred in discussions of the life of rail in track through failure to give due consideration to the variations in the tonnage carried on different portions of the line. The life of rail is very largely proportionate to the tonnage carried, but not directly so since the rail in light traffic lines cannot be kept in track for a sufficient number of years to carry the same tonnage that is carried by rail in the extremely heavy traffic lines. "Much is to be gained", he said, "by following the definite policy of removing all defective rails from the track. Roadmasters sometimes make it a point to leave these rails in track with the idea that they will influence the impression on the system officer who checks their recommendations for renewals. Adequate supervision should be exercised to prevent this practice.

The building up of battered rail by the oxy-acetylene process was generally advocated as one of the most effective means of deferring rail renewals. The question was raised as to the suggestion made by Mr. Cheney that this welding process be applied to the repairing of nicks or wheel-burned spots in rails, on the ground that this practice resulted in internal stresses which made the rail dangerous, tests being cited to show that rails so treated broke with a test drop of only one foot. The concensus of opinion seemed to be that this practice is not to be recommended for rails in high speed track. This led to a general discussion of the question of wheel-burned rail, the conclusion being that any rail that was snow-burned had been subjected to temperature conditions which made it unsafe for track carrying fast traffic.

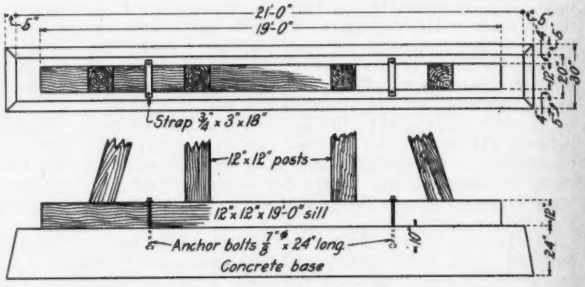
Considerable difference of opinion arose as to the practice of moving the high rail over to the low side on curves. One of the speakers, while endorsing this, cautioned against deferring this change too long since nothing would be gained by moving over the high rail if it had become worn excessively before the change was made. He also advocated the use of worn tangent rail for the high rail on curve instead of renewing it with new rail. "Old rail," he said, "gives better results because of the greater hardness produced by cold rolling in service." Another speaker objected to this because the change in the position of the rail bearing could easily result in reversals of stress and lead to breakages.

Concrete Footings Solve Trestle Bent Problem

By George Koontz
Division Engineer, St. Louis-San Francisco, Fort Worth, Tex.

In the July issue of *Railway Engineering and Maintenance* two answers were published to the question, "Where a trestle must be supported on exposed bed rock so as to preclude the use of pile bents, how should the frame bents be anchored to hold them in place?" The following is offered as a further answer to this problem.

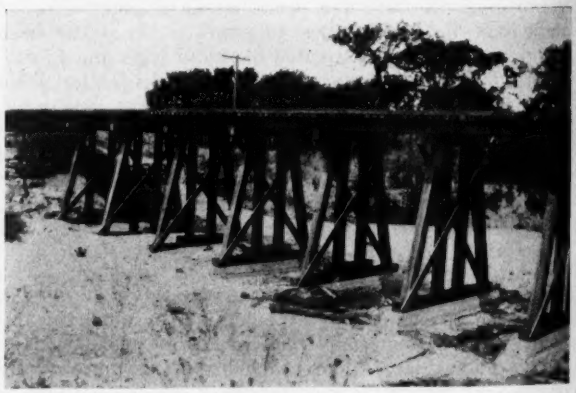
On the division south of Fort Worth, Tex., the St. Louis-San Francisco crosses many waterways which have



A Plan of the Concrete Footing

rock beds. Since it is out of the question to drive piling at these points, the practice has been adopted when building trestles to clear away the earth above the rock and build concrete footings, with their tops at an elevation sufficient to avoid trouble from water and drift.

The illustrations show a structure which has been built in this way. In this instance, the footings are 30 in. wide



A Portion of One of the Trestles Consisting of Frame Bents on Concrete Footings

at the base and 20 in. across the top and 24 in. high. The sills are 12 in. by 12 in. timbers, whose lengths vary according to the height of the frame bents. Two ⅞-in. by 24-in. anchor bolts are inserted in the footings between the plumb and better posts on each side of the bent and extend 14 in. above the footings. These bolts are spaced 13 in. apart so that the 12-in. by 12-in. sills are slipped between them. A ¾-in. by 3-in. strap 18 in.

long is laid across these sills and screwed down on to the anchor bolts, holding the sills in place.

Constructed in this manner, it is only necessary when it is desired to take the sill out for some reason or other, to set jacks on the concrete footing at the plumb posts of the bent and raise the posts off the dowels and daps with the aid of chain blocks, after which the straps may be taken off and the sill slipped out and a new one inserted. Thus, it is not necessary to cut any anchor bolts and the sill is above the water at all times.

Instructions for Cutting Rail

TRACK work embraces many operations that can be done in more than one way. Unfortunately, some methods are not as good as others and many officers in charge of track maintenance have neither taken the trouble to find out which method of doing a particular piece of work is best nor insisted that the foreman do the work according to the method which has been found to be the most effective from the standpoint of economy, safety and quality. As a result, even in such a common task as the cutting of a rail it has been found that many foremen use methods that are both slow and cumbersome.

As a means of correcting this condition, H. M. Lull, chief engineer of the Southern Pacific, Texas and Louisiana Lines, has taken steps to ascertain the best method of cutting rail and recently prepared a chart of instructions for doing this work, which chart was issued to the foremen. This comprises a series of six photographs showing the various operations in the proper order, each photograph being accompanied by a clearly stated explanation. The issuance of this chart, together with explicit instructions to supervisory officers, requiring them to see that the foremen follow instructions, should be effective in standardizing practice with regard to this operation. The chart is reproduced herewith:

FIRST: Begin by carefully instructing men how to place their hands and feet to avoid accident. Make a pencil or chalk mark entirely around the rail at the point where the cut is to be made. Do this carefully as a guide line for the chisel, so the cut will be square. Use a good sharp chisel, also a sledge instead of a spike maul. Place the rail in position shown by Photograph No. 1 and cut the base with the chisel about ⅛ in. deep from the edge of the base to the web. Do this on both sides. Follow the guide line closely with the chisel.

SECOND: Place the rail as shown in Photograph No. 2 and cut the edge of the base about ¼ in. deep, exactly on the guide line. Do this on both sides. In turning the rail, men should not take hold of it close to the blocks on which it rests —there will then be no danger of mashed fingers. In Photograph No. 2 the chalk mark guide is clearly shown.

THIRD: Place the rail in the position shown in Photograph No. 3 with the base up. Cut with the chisel along the guide line about ⅛ in. deep for the entire width of the base.

FOURTH: Place the rail in the position shown by Photograph No. 4. Men with bars put strain on rail while a few blows are struck with the chisel point on the guide line on the web of the rail. This will cause a crack to start at the edge of the rail base on the under side. The rail should then be turned over and the operation repeated on the other side.

FIFTH: When cracks have been started on both edges of the rail base as described in the foregoing, rail should then be set up work-ways as shown in Photograph No. 5. Men with bars then put a heavy strain on the rail while a sharp blow is struck with the chisel on top of the ball, on the guide line—this will cause rail to break clean and square exactly at the place desired. Photograph No. 5 was taken immediately after the break was made and shows clearly the last step of the operation.

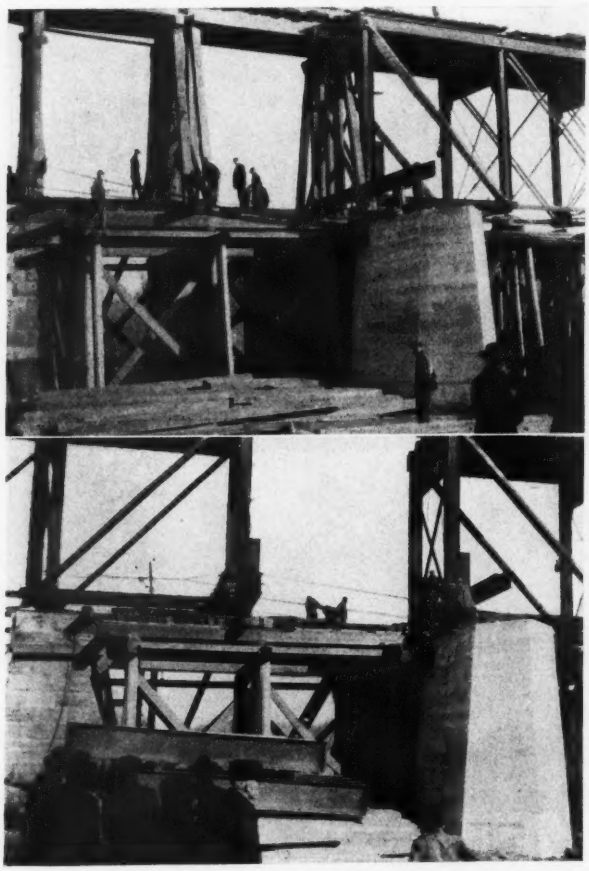
SIXTH: Photograph No. 6 shows the clean square break which will always result if these instructions are followed. The burrs made by cutting with chisel should be smoothed off before the rail is put in track so that the angle bars will fit properly.

Reproduction of the Instruction Chart on Rail Cutting

Bridge Spans Rolled 43 ft. Endwise to Place Them on New Piers

Substructure of Des Moines River Bridge of the Santa Fe Renewed in an Interesting Manner.

THE ENDWISE shifting of a bridge superstructure for the purpose of fitting it to the location of new piers was carried out successfully on the Atchison, Topeka & Santa Fe in a manner that is of interest to railway officers. The bridge in question is the Des Moines River crossing of the railroad near Dumas, Mo. As built in 1887, this bridge consisted of six 150-ft. deck truss spans supported on sandstone masonry



Closing the Gap Between the Easterly 150-ft. Span and the Shortened Span at the East End of the Bridge

abutments and piers. While the abutments are still in good condition the piers had become so badly disintegrated as to require their renewal. The construction of new piers in the location of the old ones was deemed impracticable and in carrying out the alternative of constructing new piers on new locations, requiring the shifting of the spans, it was considered better to locate the new piers a sufficient distance from the old ones to insure against any possible undermining of the old pier foundations. Accordingly, new piers were constructed 43 ft. east of the west abutment of each of the old piers, this distance being equal to the length of two panels of the trusses. To fit the superstructure to this new location of the piers not only required the shifting of the spans eastward 43 ft. but it also necessitated the shortening of the easterly span by two panels and provision for a new span of 42 ft. between the west abutment and the new westerly pier.

Following the construction of the new concrete substructure, which is founded on rock, the old east span was placed on full falsework, one panel was cut off at each end and the span moved eastward until its ends coincided with the bearing positions on the east abutment and the new east pier. The space between the west end of this span and the east end of the next span to the west was then filled by two spans of frame trestle supported on the falsework between the new and old piers.

Falsework consisting of pile bents, stringers and ties was also placed in the space between the west abutment anl the new west pier and between each pair of new and old piers. The five westerly spans were then jacked up to remove the bearing castings and to insert a grid of 85-lb. rails extending over the falsework between the new and old masonry. On top of these rails, directly over each of the old piers, nests of four-inch steel rollers were installed and on top of these a second grid of 85-lb. rails was inserted with the heads downward. The spans were then lowered into place on the rolling rigs thus formed.

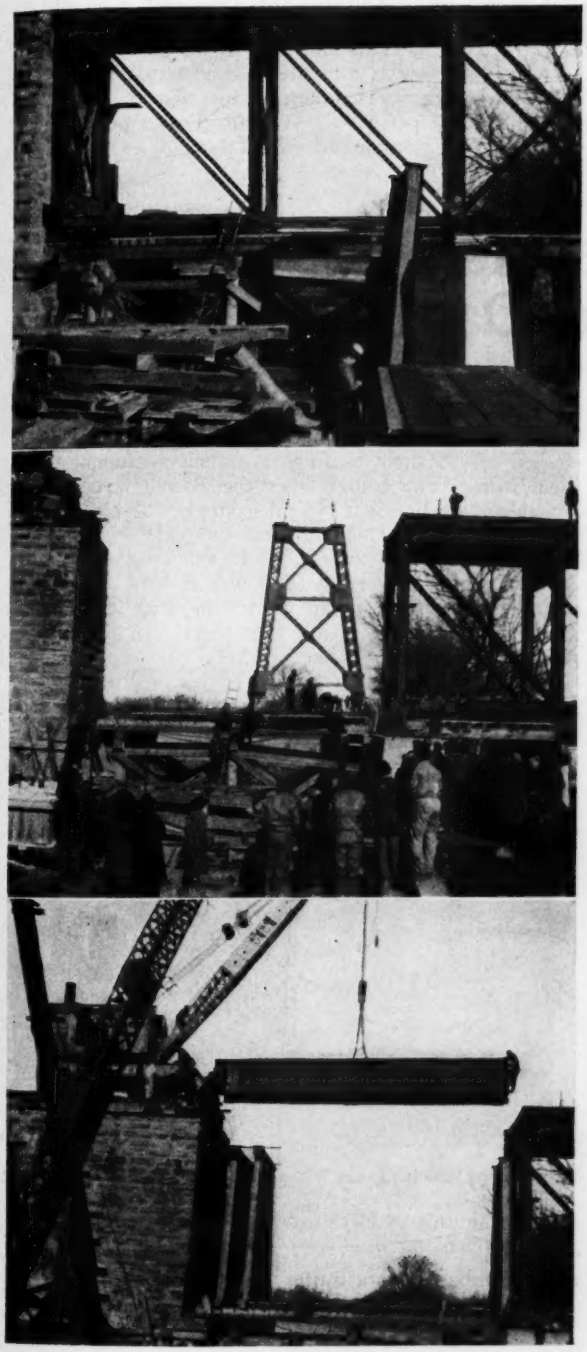
One complication entered into this feature in the work through the fact that the details of the ends of the old trusses were such as to afford no opportunity for inserting jacks in a position that would permit of supporting the entire weight of the spans on them. In consequence, it was necessary to devise a jacking rig for each end of each span. This was made of two I-beams placed crosswise on the bottom chords directly behind the end posts, the beams being long enough to project beyond the sides of the trusses a sufficient distance to give adequate space for placing jacks underneath them. The load of the trusses was transferred to the beams by means of short struts or brackets resting on top of the beams and securely drifted and bolted to the back side of the end posts.

The jacks were 500-ton hydraulic jacks operated from a single high pressure pump through the agency of a system of copper tubing connecting the pump to all of the jacks. After the jacking operation on the ends of the old piers had been completed, the jacking system was dismantled and each of the jacks was transferred to a corresponding position on the new piers and again connected up ready for operation.

After the five westerly spans had been placed on the rolling rigs they were securely lashed together end to end and two hoisting engines placed in a convenient position near the east end of the bridge were connected by hauling tackle to the east end of the spans. When all preparations had been completed on the day set for the movement, and after a passenger train had passed over the bridge at 9:51 a. m., the rails at the ends of the five spans to be moved were disconnected and the frame trestle in the space between the easterly 150-ft. span and the revamped 110-ft. span was removed. The signal was

then given and the two hoisting engines started hauling in on the tackle.

The transfer of the spans to position over the new piers was completed in about 10 min. The spans were then in position with the jacking beams directly over the jacks, which were immediately set at work raising the



Three Views at the West Abutment—(top) Before Spans Were Shifted, (center) Swinging in the Steel Bent, (bottom) Erecting the Girder Span

span a sufficient amount to free the rolling rigs so that they could be removed. In the meantime, work was started on the erection of the 42-ft. girder span to close the gap between the west abutment and the west pier. The first step in this operation was to insert a steel bent on the west pier adjacent to the west end of the westerly truss. Next, the girder span was put into place, after which the ties and rails were inserted and the track connected up ready for the passage of trains. The first train passed over the bridge at 3:15 p. m.

One train, a passenger train, was delayed one hour and three minutes by the operation, but freight trains were held at terminals until such time as insured no delay on the road.

The substructure work was done by the Missouri Valley Bridge & Iron Company, and the movement of the spans was handled by the American Bridge Company, assisted by the bridge and building forces of the Santa Fe. All of the work was conducted under the direction of A. F. Robinson, bridge engineer, Atchison, Topeka & Santa Fe System, to whom we are indebted for the above information.

Take Care of Cement Sacks*

PORTLAND cement, as commonly used in railroad construction, is shipped in cotton sacks, each containing 94 lb. of cement. These sacks are not sold with the cement but are loaned to the railroad with the understanding that the empty sacks are to be returned. According to the cement manufacturers' figures, the sacks cost 25 cents each and the railroad is required to pay from 10 to 25 cents per sack for all sacks not returned or that are in such condition when received at the mill that they cannot be used again.

During 1923, 552,000 sacks of cement were used on the Illinois Central and the Yazoo & Mississippi Valley railroads. There are no means of determining accurately the loss to the railroad in sacks that were not returned or that were rejected at the mill, but from the records of one cement company which furnished a considerable amount of cement to the Illinois Central, it was shown that out of a total of 41,000 sacks of cement shipped during a period of about seven months, only 49 per cent of the empty sacks were returned. As this report was prepared 11 months after the last shipment of the cement in question was made, it is quite probable that the remaining 51 per cent of the sacks had been lost or destroyed. As an example of what may be done in salvaging empty cement sacks, during the construction of the new Kankakee River concrete arch bridge, a total of 104,203 sacks of cement was used and of this amount there was a net loss of less than one per cent of the number of sacks received. This was due to the care taken in handling and storing the cement, in properly handling and checking up the sacks as they were emptied, and in returning them promptly to the cement house.

The two examples cited above showing a loss in cement sacks ranging from 1 to 49 per cent probably cover the two extremes with an average loss around 20 per cent, while the rejection of cement sacks returned to the mill varies from 1 to 5 per cent. Cement manufacturers agree that railroads are the worst offenders both in neglecting to return empty sacks and in the number of damaged sacks rejected at the mill.

The proper handling of cement sacks to insure the minimum loss demands that each sack be thoroughly shaken as emptied to remove all cement. It should then be placed in a pile, using the necessary precaution to prevent the sack becoming wet. From time to time during the day or at the end of the day's work, the sacks should be removed to the cement house, counted, sorted and tied in bundles and piled in the space provided for temporary storage.

*From the Illinois Central Magazine for March, 1924.

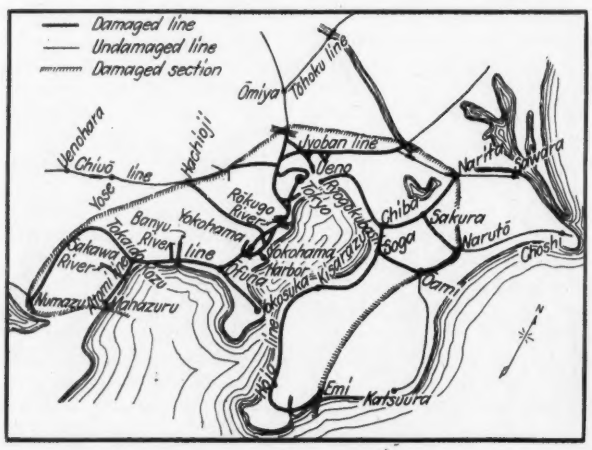
As previously stated particular care should be used to remove all cement possible from the sacks as, under the most favorable conditions, some cement will remain in the fibres of the cloth. For example, 100 new sacks weigh about 44 lb. while 100 old sacks weigh about 80 lb., the difference of 36 lb. representing cement left in the sacks.

Among common abuses in the use of cement sacks are the throwing or dropping of sacks of cement, causing them to burst; improper storage, resulting in the cement becoming wet and destroying both the cement and the sack; cutting or otherwise damaging the sack in opening it; the use of empty sacks as sand bags, their use by workman as aprons, overshoes, etc., loss by theft and careless handling in transit, their use as rags for swabbing up mud and water or for chinking cracks in cofferdams and sheeting and as covers to protect work or material from the elements. These are only a few of the common forms of abuse to which cement sacks are subjected, causing a heavy expense that could very easily be avoided.

It should be remembered that each sack destroyed or rejected represents an unnecessary expense to the railroad of from 10 to 25 cents and even at the lower rate of 10 cents a conservative estimate of the actual loss to the Illinois Central from damaged cement sacks amounts to nearly $12,000 per year. A carload of empty cement sacks is worth several carloads of cement.

Survey of Japanese Railroads Shows Earthquake Damage

THAT the railroads were not the least among the sufferers in the terrific earthquake which visited Japan on September 1, 1923, has been clearly shown in a report prepared by Dr. Mitsuo Nawa, engineer, Government Railways of Japan. This is particularly evident in the map which shows the affected area wherein it is seen that the lines most affected lie within the terminal area of Tokyo and Yokohama or immediately adjacent to it. The following also summarizes the extent of the damage done:

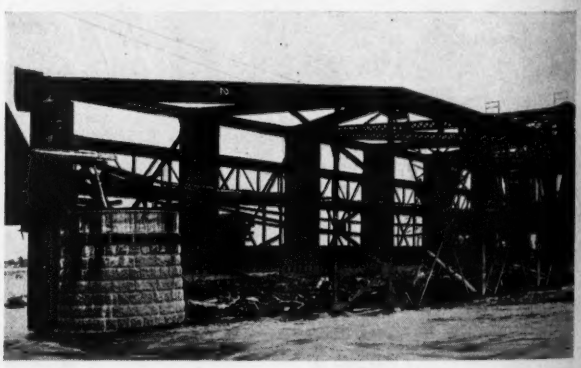


Map of Japan in the Vicinity of Tokyo and Yokohama Showing Railway Lines Affected by Earthquake

Area of districts damaged by the earthquake, about 3.27 sq. mi.; Lines damaged, 422.4 mi.; Number of bridges damaged, 68; Total length of damaged parts of bridges, 15,285 ft.; Number of tunnels damaged, 36; Total number of tunnels in the damaged districts, 71; Total length of the tunnels in the damaged districts, 68,465 ft.; Total length of damaged parts of tunnels, 4,624 ft.; Number of main buildings of stations damaged—Burned: brick work, 4; wooden, 13; Entirely or partly collapsed: wooden, 22; Number of train accidents due to the earthquake, 22; Number of locomotives burned or damaged, 53; Number of passenger cars burned, 386; Number of freight cars burned, 817; Number of electric cars burned, 31.

Bridges Suffered Severely

The damage to bridges arose primarily from the displacement or disintegration of the masonry work. Bridge piers were destroyed or moved badly out of place and abutments in many places were crowded forward by the embankments. Steel superstructures were damaged primarily through the destruction or displacement of the substructures, although in some cases the spans were shifted off of their bearings a sufficient amount to tip them over. The bridge over the Banyu river on the Tokaido main line is a typical example. It consisted of 28 spans of 70-ft. plate girders on piers of brick and stone masonry, supported on masonry caissons. The caissons were thrown out of plumb and 44 of the piers were broken off near the water line and fell into the stream, carrying the spans with them. In the Sakawa river bridge on the Atami line, a 150-ft. truss span was shaken off its bearings and turned over on its side in the stream. There are no long span arch bridges in the district affected, but a great many small arch bridges and culverts were badly cracked or destroyed because the side walls or abutments were forced in by the lateral pressure of the embankment.



Overturned 150-ft. Truss Span of the Sakawa River Bridge

Embankments Suffer on Reclaimed Land

A considerable mileage of railway line within the affected area is located on reclaimed land which offers very low resistance to earthquake shock. Consequently, embankments on such lines were either badly cracked or largely destroyed by subsidence. This condition was encountered at a number of railway stations, resulting in the destruction of the station buildings. The earthquake also resulted in serious slides in the mountainous districts where the condition was aggravated by heavy rainfall following the earthquake, which entered into cracks in embankments and resulted in mud flows.

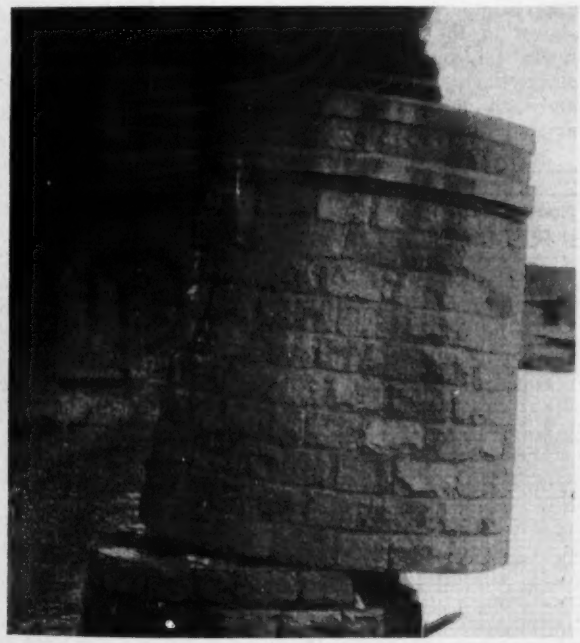
The most serious occurrence as a result of landslide took place near the Nebukawa station on the Atami line where the main station building, together with a passenger train standing at the station, were plunged into the sea, killing more than 100 persons, including both passengers and the train crew. Tunnels were also affected by the

The Spans in the Banyu River Bridge Were Restored on Temporary Piers

earthquake but the damage was not great considering the large tunnel mileage in the affected area.

In the Tokyo Terminal

One of the important features of the railway development in Tokyo is a track elevation structure consisting of a large number of brick and reinforced concrete arches of 26 ft. to 40 ft. span, including spans of greater length over some of the streets and a canal. This elevated line sustained almost no damage from the earthquake itself, but suffered to some extent from the fire owing to the fact



How One of the Piers of a 120-ft. Span Was Sheared Off at the Water Line

that the space under some of the arches had been filled with inflammable material which caught on fire and caused considerable flaking of the concrete through the effect of the intense heat.

The main Tokyo station, which is a three-story building with steel frame and brick walls, sustained no damage, but several of the other stations were gutted by the fire. Many other railway buildings in the city were either badly injured by the earthquake or destroyed by the fire. As shown by the summary, a large amount of rolling stock was burned, the earthquake damage comprising merely derailments or overturning. A considerable amount of equipment was involved in train accidents where trains on the line were derailed or overthrown at the point where they were caught by the earthquake.

Conclusions Drawn

The following are a few of the conclusions offered by Dr. Nawa based on his study. The resistance which embankments offered to earthquake shock is very low, consequently the construction of high embankments or dams must be carried out with unusual caution.

Brick or stone masonry offer low resistance to earthquake shock. Plain concrete work has about the same resistance to earthquake that brick work has.

Steel frame buildings offered the highest resistance to earthquake and iron frame buildings with reinforced con-

Overturning of Piers Resulted in Complete Destruction of the Banyu River Bridge

crete walls also afford excellent results and come next to steel frame buildings with good brick or hard stone curtain walls. Hollow tile or terra cotta curtain walls suffered severe damage.

In point of resistance to earthquake, reinforced concrete work comes next to iron work, but must be adequately braced with properly disposed curtain walls.

The Number and Wages of Maintenance Employes

THE Bureau of Statistics of the Interstate Commerce Commission has issued a report for the 12 months ending December 31, 1923, showing the number of employees and the amount of their compensation, grouped by departments and duties for the Class I roads of the United States. This report indicates that the number of employees in the maintenance of way department increased 38,935 or 10.7 per cent over the previous year, while their compensation increased $59,409,516 or 15.4 per cent. Maintenance of way employees constituted 21.37 per cent of all those in railway service. Their

total compensation aggregated $444,303,536. These statistics are shown in more detail as follows:

	Average number of employees	Average monthly earnings per employee
Roadmasters and general foremen (M. of W. & S.)	3,294	$245
Assistant general foreman (M. of W. & S.)	322	210
Supervising maintenance of way inspectors and scale inspectors	319	184
Maintenance of way inspectors	640	174
Bridge and building gang foreman (skilled labor, M. of W. & S.)	5,440	166
Bridge and building carpenters	23,507	120
Bridge and building ironworkers	991	143
Bridge and building painters	3,565	117
Masons, bricklayers, plasterers, and plumbers	2,159	149
Skilled trades helpers (M. of W. & S.)	11,028	97
Regular apprentices (M. of W. & S.)	171	80
Portable steam equipment operators (M. of W. & S.)	2,117	166
Portable steam equipment operator helpers (M. of W. & S.)	842	117
Pumping equipment operators	6,249	82
Gang foremen (extra gang and work-train laborers)	4,170	142
Gang foremen (bridge and building, signal and telegraph laborers)	682	165
Gang or section foremen	40,080	125
Laborers (extra gang and work-train)	58,310	81
Track and roadway section laborers	210,913	74
Maintenance of way laborers (other than track and roadway) and gardeners and farmers	8,401	74
General foremen and supervising inspectors (signal, telegraph and electrical transmission)	545	242
Assistant general foremen (signal, telegraph and electrical transmission) and signal and telegraph inspectors	588	215
Gang foremen (signal and telegraph skilled-trades labor)	1,180	191
Signalmen and signal maintainers	8,057	157
Linemen and groundmen	2,535	145
Assistant signalmen and assistant signal maintainers	2,386	119
Signalmen and signal maintainer helpers	3,232	97
Daily basis } Hourly basis }	4,749	239
Total (maintenance of way and structures)	396,974	90
	401,723	

Keeping a Check on Painting

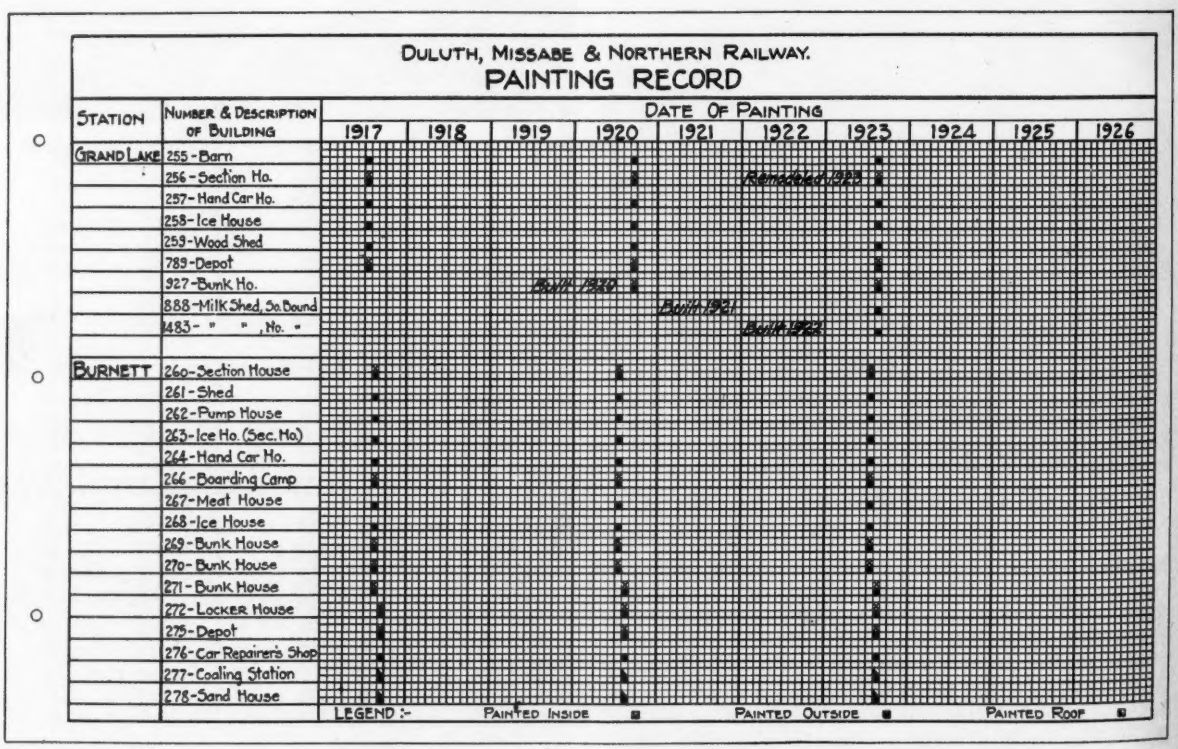
By F. C. Baluss

Engineer Bridges and Buildings, Duluth, Missabe & Northern, Duluth, Minn.

THE COST to the railways of maintaining the surfaces of their wooden and steel structures constitutes such a large part of the total maintenance expense that the importance of a convenient and dependable painting record is readily seen. Generally it can be expected that a life of three or four years can be obtained from the painting of a wooden structure, and from five to eight years with a steel structure, although, due to climatic or other conditions, these periods may vary considerably. Maintenance officers should give this subject the study it deserves and apply the appropriate remedy whenever it is found that painting costs are becoming excessive by reason of frequent painting. Among the causes for this may be found a lack of proper preparation of the surface to be painted, bad workmanship, the use of poor materials or those unsuitable for the purpose.

As the number of structures in any maintenance officers' district will run from several hundred to one thousand or more, the difficulty of keeping a check of painting costs is apparent. The maintenance officer of the Duluth, Missabe & Northern endeavors to do this by a combination of field and office records. The exterior painting date is stenciled on each structure in two places, one on the right hand side of the front of the building and the other stencil on the right hand side of the rear of the building.

The interior painting date is stenciled over the front and rear doors of the building. Bridge painting dates are shown at each end of the bridge on the right hand side when approaching it on the track. These dates are shown in figures about one inch high and designate the month and the year, as 8-23 for August, 1923. For an office record the painter foreman reports at the end of each month the number and name of each structure painted and indicates exterior and interior work. This information is then placed upon a painting chart by appropriate symbols. This chart is made of sheets as shown in the accompanying illustration, or it may be made of 12 by 12 cross-section paper cut into the desired size. Each division of the inch represents one month and each inch one year. It is bound in a loose leaf binder and additional sheets may be added as necessary.



A Typical Sheet from the Painting Record

A Review of the Tie Renewal Problem

Roadmasters Discuss the Selection of Ties to Come Out, the Distribution of New Timber and Other Phases of the Work

WHAT to do with ties that have been removed too soon, the value of dating nails, the relative advantages of work train and motor car distribution, the best method of selecting ties for renewal and many other phases of the tie replacement program were discussed at a meeting of the Maintenance of Way Club of Chicago on March 19. The discussion was led by P. J. McAndrews, roadmaster, Chicago & North Western, Sterling, Ill., who discussed the method of determining what ties must be renewed. D. O'Hern, roadmaster, Elgin, Joliet & Eastern, Joliet, Ill., then described the method he uses in distributing ties; following which James Sweeney, supervisor, Chicago & Eastern Illinois, Danville, Ill., presented a paper on the method of putting the ties in the track. Their remarks were followed by a general discussion which brought up a number of points not covered by the first speakers. Following is an abstract of the papers and discussion:

Inspection and Distribution

P. J. McAndrews: Our tie renewal program is carried on in connection with the general surfacing of the tracks with stone ballast. We find it advantageous to raise 50 per cent of the track on each section each year. In getting at the actual ties to be renewed, we use a mimeograph form. The section foreman submits his estimate on this form to the roadmaster who in turn looks over these estimates and through his knowledge of each particular part of his territory knows whether or not it represents the approximate number of ties required. This means that his territory should be of such length that he can give close attention to this feature of the work. In my opinion, many territories now assigned to roadmasters are entirely too long for them to give full attention to this work as well as other track maintenance.

In the inspection of ties for determining what renewals are to be made, we do not use picks. I believe an experienced roadmaster or foreman can do this without using a pick or any other tool. But some will ask about the ties removed by the foreman which are found to have at least a year's life left in them. The answer is that the roadmaster should talk to the foreman about this problem on the ground.

The roadmaster's inspection of ties for renewal next year should include a close examination of the ties that are renewed this year as a means of showing the foreman how to avoid wastes the following year. I do not believe that ties should be burned immediately after being taken out of track, except where authorized inspectors have marked the ties. We do not allow the foreman to destroy or otherwise dispose of old ties until the roadmaster has passed on them. I believe that the roadmasters as a whole are deeply interested in their work and realize fully the expense involved in tie renewals and that they are very careful about any particular wastes in this line of work. It may be that the sending of inspectors from the general office is a good plan, but I doubt it.

D. O'Hern: In distributing our ties we bill them in carload lots to each station and to any spur tracks between stations. All ties that would have to be trucked more than ¼ mile from stations or spurs are delivered by a work train, say of 12 cars, with four men to the car. We unload 25 ties from each car at each stop. On my territory two days' service of the train will distribute all the ties needed at points between stations or spur tracks. Ties are expensive and the less we handle them the better. The less we truck them the less the cost of handling.

The Method of Renewing

James Sweeney: I do not know a more practical way of outlining the method to be followed in renewals than to draw an imaginary case of some foreman and give him my opinion on how to put in his allotment of ties. He has a four-mile, double-track section with a small yard. The northbound track needs a large number of new ties, while the southbound track requires rather light renewals. I would approach the subject this way:

"Well, John, I guess you had better start putting in ties on Monday. If I were you I would get after the northbound track first and give it about 2½-in. lift. This will give you a chance to get your ties in easier and faster and you can come back on the southbound track with the few you have there, while you are picking up the low joints later in the summer. First, pull all the spikes out of the ties that are to come out and raise the track high enough so you can pull the old ties out. Then let the track down where it belongs.

"Now in pulling out the old ties I don't have any pet hobby. You can use picks or tongs. A pick comes handy to me, but I have learned not to use one on a new tie, and if you don't teach your men anything else all summer try to get it fixed in their minds that a man who would hit a defenseless treated tie with a pick is no gentleman.

"But to get back to the track! After raising several rail lengths get your men back to spacing ties and putting new ones in. Two men are enough to handle a tie and the gang should be spread out enough to keep them from getting in each other's way and doing too much visiting. Unless too many are taken out I have always found it better to wait and do the spiking after they are all tamped up. You will find it easier to gage the track and the spiking will move along faster. By arranging your work in this way you can put some of your men to piling up the old ties and burning them.

"The burning of the old ties can easily become one of the worst sources of waste in track labor. A big pile of burning ties is a fire menace and will often burn after the men have gone home. It also takes considerable extra labor to make a big pile and you will find it much cheaper and better to pile them in many small piles than in a few large ones. The oak ties burn up readily in such piles and you can have them all cleaned up and the fire out before you leave at night.

"When you get in the southbound track do not disturb the track at all. It will take a little more time to dig the ties out, but I do not want the ballast bed broken up any more than you can help. Do not dig too deep for the new tie and then tamp it up tight without the tie plate. After this is done get your tie plates on and the track will be stiff enough to prevent the ties working in water.

"In both tracks you may find a few bad ties that were not marked to come out. On the other hand, you should find about as many that were marked to come out but which are good enough to leave in. To judge which tie to take out and which to leave in is about the hardest

thing a foreman has to face. I like to think of a tie costing a 'quarter' a year and for every tie I can leave in another year I have saved a 'quarter.' That is why I am not in favor of renewing ties out of face.

"When you put in switch ties dig all the material out between the ties. Then you can get the ties out more easily and to a better surface, as the material, if left in, will be getting in under the ties. You will, no doubt, find a few good ties and these you should save to patch up with on the side tracks where you find a few bad ones.

"There is another matter we must not overlook. You are never sure of a tie until you have it in the track and have four spikes in it. You have quite a few ties out along the track. Each one represents close to two dollars and they make fairly good gate posts and sills for pig pens and corn cribs. Now don't misunderstand me. Not one foreman out of ten prefers them to what he can buy, but the truth is, a man may take a fancy to this particular kind of building material, and it is your business to know how many ties you have all the time. If any are short some morning I want to know it. For that reason, criminally wasteful as it may seem, do not give the old ties away, for old ties and new ones so often get all mixed up in the hauling."

J. J. Desmond (I. C.): "I would like to ask Mr. McAndrews about the use of the mimeographed form on which his foremen make out requests for new ties. Is it necessary to change the foreman's recommendation to any extent?"

Mr. McAndrews: "In some cases it is."

Mr. O'Hern: "In case one of your foremen makes a mistake in taking out ties, what disposition do you make of these ties and what do you do to correct it?"

Mr. McAndrews: "I talk to the foreman about it, and mark the ties, if they are to be saved. If they have a couple of years' life left we use them in temporary or material tracks that do not require much strength."

H. F. Bloom (North Shore Electric): "In the fall when we inspect our ties we start at the end of each section and number the trolley poles. Then as we go along inspecting our ties we stencil the number of ties required for each pole panel on the back of the nearest pole. We use work train service for distribution and unload the number of ties indicated by the stenciling on each pole."

Mr. Desmond: "We must place a value on ties in order to educate our men. If there is any more life left in some of the ties, how shall we use them?"

Mr. O'Hern: "We turn the tie over and put it back in the same place. I don't believe it pays to truck it any distance. We do not take ties from a main track and put them into sidings because that means money spent for trucking."

T. Thompson (A. T. & S. F.): "How does mechanical wear influence renewals? It is our practice to watch this mechanical wear carefully and when a tie is badly rail cut we will not make an effort to save it."

Mr. Desmond: "We have some ties on our railroad that have been in service as long as 40 years and they have been faced down to take care of mechanical wear. Of course, these ties are usually protected by good ties on each side, but it is surprising how long hard pine or cypress ties will last."

Mr. O'Hern: "Do you turn these ties?"

Mr. Desmond: "No, sir."

M. D. Carothers (B. & O. C. T.): "We distribute our ties by motor car. We lay them parallel to rail and pile them carefully. In that way, we have a neat looking railroad at all times. Turning a tie over is false economy. It takes 10 or 15 min. to take out the spikes and turn it. We burn old ties as soon as they are passed on by the supervisor."

Mr. O'Hern: "Do you lay your ties near the track or on the grass line?"

Mr. Corruthers: "We lay them close to grass line so that there is no obstruction for men getting on and off freight trains."

A. Rost (B. & O. C. T.): "If an old tie is good for only one year, why turn it over, it won't last any longer? If you have to take it out, destroy it. If you have a foreman taking out ties that should not be taken out you must talk to him. I do not think that ties should be unloaded by work train. It ties up the road. A foreman can distribute ties by motor car in winter time when he cannot do much else and when the time comes to put in ties he is ready. I think we can do the work cheaper by motor car than with a work train."

Mr. McAndrews: "I think that every tie should have a dating nail put on it. When the roadmaster knows the tie was put in he will give more careful consideration before taking it out. As to distribution—out in the country where we have stations 6 to 9 miles apart we find it necessary to use work trains. At the present time we are getting ties of several grades in the same cars, but we are trying to get them shipped separately. The work train is part of the maintenance work and material should be furnished in a way that will enable the roadmaster to use the train most economically. The use of way freights is expensive."

Mr. Carothers: "The motor car of years ago was not the machine we have today. With a high power gas engine I do not see why a motor car would not be just as economical as a work train even if you have to clear for other trains. I cannot see any economy in using work trains even on a trunk line."

Mr. McAndrews: "We have freight trains that run 45 miles an hour. I do not think it safe to use motor cars under such conditions."

Mr. Thompson: "We require the section foreman to fill out a form every month for ties removed from the track. On this form he shows the date on the nails in the ties taken out, so we have an absolute record of how long each tie has been in the track. In marking ties to come out I handle the work about as outlined by Mr. McAndrews. I go over the foreman's report and as there are some foremen who will order more than are needed, I cut down their estimates. When the ties are received we unload all that are to be inserted within two miles of town in the station yard and when the section foreman goes over his track on his motor car in March, I have him take out two or three ties each trip. I do not favor this practice where the section is on curved track because it is dangerous."

Mr. McAndrews: "Do you think the dating nail makes foremen more careful?"

Mr. Thompson: "I think they are a good thing."

Mr. McAndrews: "Does your railroad follow the practice of having an inspector inspect the ties before burning?"

Mr. Thompson: "The inspector comes out and looks at every tie. The roadmaster accompanies him and in a good many cases the section foreman also goes along."

Mr. O'Hern: "If, in your judgment, foreman has made a mistake, what do you do with the tie?"

Mr. Thompson: "I set it aside for use in yards and on unimportant tracks. The dating nail makes the foreman and the roadmaster more cautious. You know, as well as I do, that some foremen take out ties that should not be taken out. When you pay $2 per tie, plus the labor of putting it into the track, I think it mighty expensive and everybody in connection with maintenance work should be careful."

The Machine Is Designed to Make Lifting Easy for Men of Limited Physical Strength.

Laying Rail with a Machine in India

Labor Saving Equipment May Be Applied to Advantage Even Where Wages Are Extremely Low

IT HAS BEEN the common understanding that most countries in the Orient, affording as they do an almost unlimited supply of cheap labor, offer an exceedingly unfertile field for the application of labor saving equipment. That there are exceptions to this rule is to be learned from an article which appeared in the Railway Gazette of London which outlined the economies obtained with a rail laying machine in India. The article is of interest not only because of this fact but also because it throws a light on the methods followed in Indian track work and particularly because it affords an insight into the extremely low efficiency of the labor available in that country. The article is reproduced below as published except for the substitution of American terminology for English usage.

The growing cost of labor in India is causing the introduction of machinery in place of manual labor in many industries, but railway track laying is still being generally done as it was 50 years ago. This is largely due to the prohibitive cost of track-laying machines as used in America and other countries, and to the difficulty of getting coolie labor to understand or use any form of machinery.

Confronted with difficulties in completing the Amda-Jamda branch of the Bengal-Nagpur railway, A. T. D. Anderson, who was in charge of the work, devised the simple but ingenious rail carrying machine described in this article. Before it was put into operation, each rail was carried by 24 men with rail slings* from the point at which it was unloaded by the material train to its place in the track, each man carrying a load of 45 lb. on loose earth and stepping over the ties. Men were hurt frequently, and eventually some absconded, when the gang was increased to 32 coolies per rail, and the 3 miles of rail laying was done at an average rate of ⅛ mile per day. This was in dry weather, but it became evident that it would be impossible to carry on in the rainy season, with slippery, wet banks, and clogging mud. After the machine had been put to work, rail laying was resumed with a total force of only 85 men, and progress was increased from ⅛ mile to 1/5 mile, and this was done in half a day's work on rail laying, the remainder of the time being spent in surfacing and lining the track. This was later increased to one-quarter mile a day and on trial it was found possible to lay and rough tamp one-half mile of track in a day. All trouble with the employment of labor ceased and when very low grade labor had to be employed it was found that they could work the machine without difficulty. The machine and the manner of its use are described below:

The Two-rail Machine May Be Converted Into a Four-rail Machine by Adding More Levers

The Machines Are Simple

The two-rail machine consists of two pairs of push car wheels and axles, four bearing boxes, four wooden levers about 3 in. by 3 in. by 12 ft. long and eight rail slings. The lever can be attached direct to the axle bearings, but with small wheels the levers are too low to work conveniently with rail slings, and blocks about 10 in. high are therefore interposed between levers and their bearings.

The bearing is bolted to the lever about 1 ft. 6 in.

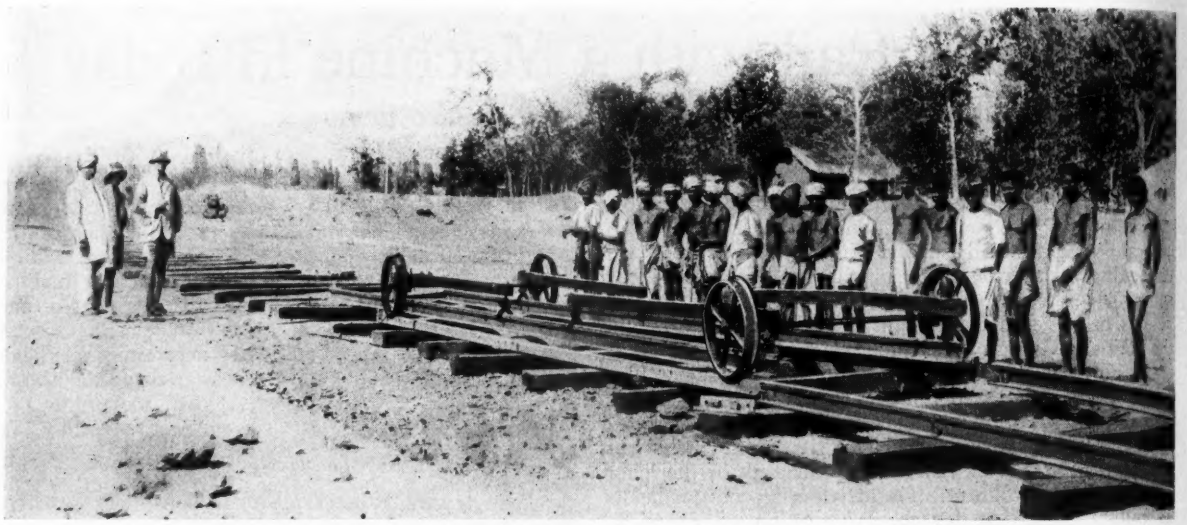
*Rail slings are tongs with a chain loop attached at the handles as shown in the photographs.

from one end, and when fitted into its seat on the wheel axle, acts as the fulcrum of the levers and also as one of the bearings of the machine when the load is being pushed out.

A rail sling is fixed to each end of the four levers. It must be realized from the outset that a machine is in two parts, each half consisting of a pair of wheels with two levers and their rail slings. The halves are not connected in any manner until a pair of rails has been lifted, and then the rails themselves form the link between the two halves of the machine. To lift a pair of rails lying in the track the two pairs of wheels are separated by rolling them along the track rails until their axles are nearly over the opposite ends of the rails. The levers are placed on the axles with the short arms towards the ends of the rails and the long arms towards the middle of the rails. The long arms of the levers are lifted until it is possible to grip the heads of the rails with the rail slings fixed on the short arms. The levers are then depressed, lifting the rails until the rail sling fixed to the end of the long arms can be clipped to the railhead at a point about 11 ft. 6 in. from the outer clip. The rails are now suspended and the levers, being clipped at two points, remain in a horizontal position, held so by the weight of the rails, and the whole machine now moves about as one unit with its load of two rails. A two-rail machine is converted into a four, six, or eight rail machine by the addition of the required number of extra levers and slings.

When four rails are suspended there is a space between the ends of the levers of each pair of wheels. This space can be utilized for carrying ties at the same time.

The rail slings on the levers are so proportioned that when a rail is lifted its head is within 2 in. of the underside of the axles, and the machine with its load is able to pass over other rails lying within the track without fouling them.



The Machine at the End of the Track with the Wheels on the Angle Iron Extension.

How Rail Is Laid

The ties are spread by contract, being carted out or carried by coolies. Two of the coolies go ahead, stretching a string from peg to peg on the center line and marking the centers on ties in chalk. Six men follow them with two steel tapes 36 ft. long which they peg down along each side. These tapes have the correct spacing of the ties marked on them by rivets. The coolies space all the ties correctly according to the tape, and center them by the string. These operations usually proceed about four rail lengths in advance of the railhead.

Two men follow the spacing coolies, driving one spike about an inch deep into the outer hole of each third tie. These spikes are intended to keep the angle-iron "machine track" roughly to gage while the machine is dropping its load in position for the application of the joints. The last pair of rails connected up are extended by two 3 in. by 3 in. angle irons which have one flange cut off for about a foot from one end and the other flange is roughly shaped to fit the web of the rail. The angle-irons are secured to the last rails by pins and cotters passing through one of the fish bolt holes of the rails and are the same gage as the track. These angle-irons form the temporary track for the machine which brings up a pair of rails and will be referred to in future as the "machine track" to distinguish it from the rail track which, it will be understood, also forms part of the machine track as far as the railhead. The angle-irons are 36 ft. long, in order that the machine may carry a rail its full length ahead of the last rail laid before dropping it. Four coolies are detailed to carry these angle-irons ahead as each pair of rails is linked in.

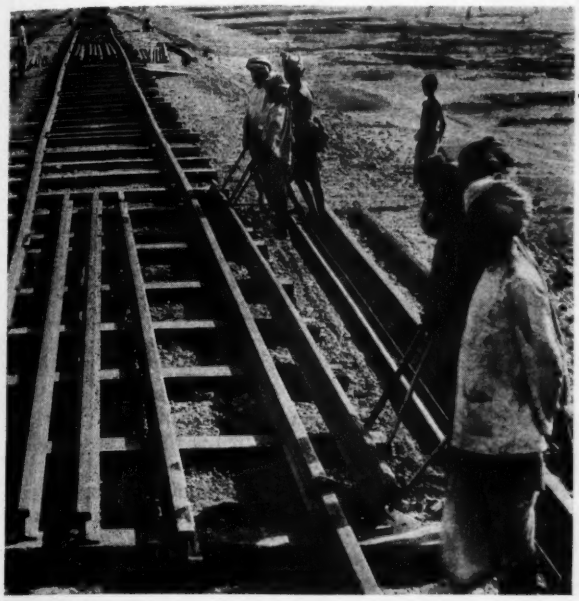
At railhead four coolies and a subforeman receive each pair of rails, detach the angle-iron cotters, slide the rails into their place, and apply the fish plates. Four coolies follow, placing spikes in both holes of every third tie and partly driving them with two strokes of their hammers. These keep the last linked rails to gage. Finally there is a spiking gang of 24 men who full spike the rails and gage the track.

Handling of Material

The material is handled as follows: The material train brings up half a mile of material and pushes as close up to railhead as possible, and the tie cars, being in front, are unloaded first to be carried ahead by contractors' coolies; at the same time eight coolies to each rail car drop eight rails on each side of each car, that is, 16 rails to each rail-length of track. The train then moves back a train length and more rails are dropped until the cars are cleared. The train then goes back to work ballast where required. The rails are then put into the track by a lever machine designed for the purpose or by the angle-iron ramps shown in one of the photos. When eight rails

have been placed within the track at each rail length the laying starts, the two-rail machine working alone at first.

As the railhead advances and the lead to the rail-dump increases, one or more four-rail machines are brought into operation to carry the rails forward to supply the two-rail machine. The two-rail machine clips up a pair of rails, is pushed along the track to the railhead, runs out on to the angle-iron "machine-track" and drops



Placing the Rails Inside the Track with the Aid of Angle Iron Ramps

its load. It is then pushed back for a fresh load and in the meantime the angle-irons are carried ahead, and the rails joined in their place, forming a fresh link in the track. When about 10 rail lengths have been placed, the first four-rail machine comes into operation. It clips up four rails at a time and drops them about three raill lengths short of the railhead. Two men are kept at each rail-dump, spacing the remaining rails after each load has been carried away, so that the machines will have them directly under their clips for lifting on their return.

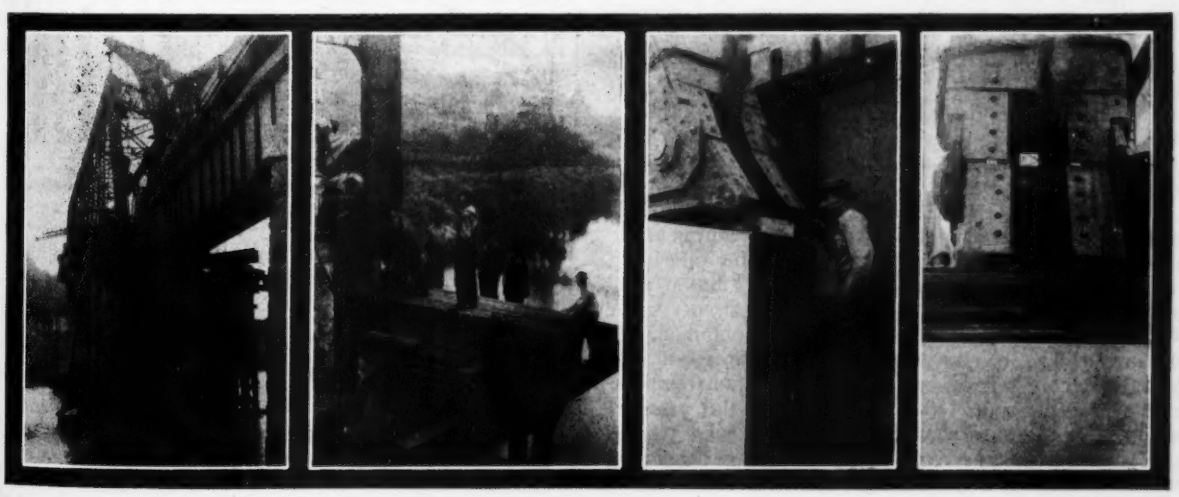
Repairing Bridge Piers Under Traffic Without the Use of Jacks

IN RENEWING the tops of stone piers supporting a steel span on the Monongah division of the Baltimore & Ohio recently, the load was transferred from the piers to falsework and back to the remodeled piers by means of a wrecking crane without the use of jacks, effecting considerable economy in the cost of this work while at the same time avoiding serious interference with traffic. The piers were of sandstone supporting a through truss span weighing about 400 tons. These piers were crushing under the bridge shoes, cracks in the pier coping extending down through three to six courses of the stone below. This condition made it necessary to renew the tops of the two piers and place concrete pedestal blocks 3 ft. 6 in. high and 4 ft. 4 in. square under each bearing shoe.

Double pile bents were driven on each side of the pier to support 24 in. I-beams which were placed under the bridge shoes. Instead of transferring the load to this falsework by means of 50 ton and 100 ton bridge jacks, the division wrecking crane was called into service. Photograph No. 1 shows the crane on the approach span transferring the truss from the pier to the falsework. Photograph No. 2 shows the I-beams in place and the wrecking derrick making a hitch around the end post pin with a 1¾-in. wire cable.

In placing the concrete pedestal blocks, it was necessary to make two lifts at each corner of the bridge, the first step consisting of the substitution of a pillar of wood blocks for the I-beams to support the bridge, while the crane took the beams off the structure and returned with the concrete pedestal blocks. Photograph No. 3 shows this step in the operation with a concrete block part way under the bridge seat. The fourth photograph shows the block in place under the roller end of the bridge and indicates the manner in which the plates were cut away from the end post and bearing to permit the crane to make a hitch. These various lifts required from 45 min. to 1 hr. and 15 min. each and were made in a way that resulted in little delay to traffic.

This work was handled under the direction of D. B. Taylor, master carpenter, at Grafton, W. Va., to whom we are indebted for the information.



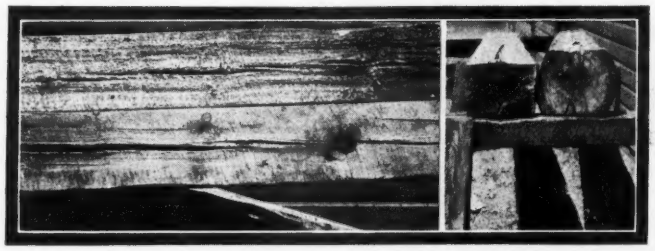
Four Stages in the Operation

Improving Methods of Treating Ties With Zinc Chloride

Experiments Show Way to Improve Treatment, Reduce Fuel Consumption and Increase Plant Output

By J. D. MacLean
Engineer in Forest Products, Forest Products Laboratory, Madison, Wis.

DURING the past two years the Forest Products Laboratory has made investigations of the relative importance of various treating conditions upon the absorption and penetration of zinc chloride solution into wood. The tests, which were made on Douglas fir, showed that solution temperature has a very important effect on both absorption and penetration and indicated that the temperatures used by many treating plant operators are lower than they should be for the most effective results.



Checking and collapse in lodgepole pine ties caused by steaming for four hours at 20-lb. pressure.

The relatively small importance which plant operators have heretofore attached to zinc chloride temperature is not surprising when the marked difference in the visible effect of temperature on preservative oils and on water solutions is considered. The viscosity of oils is noticeably affected by heating, but with zinc chloride solution the change in viscosity is not so easily detected. Nevertheless there is an appreciable change and it apparently has a marked effect upon the penetration of the solution into wood.

Tests Were Arranged

It was believed that the information obtained from the laboratory experiments could be applied to advantage in commercial practice and would result in greater economy of plant operation and in more effective treatments. With this end in view co-operative experiments were undertaken with the Union Pacific Railway Company as a study in the practical treatment of lodgepole pine and coast Douglas fir ties with zinc chloride solution. Arrangements for the work were made with the company through M. M. Rabourn, superintendent of the Union Pacific timber treating plant at Laramie, Wyo. Under his direction experimental equipment similar to that in use at the Forest Products Laboratory was installed at Laramie.

The prevailing practice in treating seasoned lodgepole pine ties at the Laramie plant has been to steam at 20-lb. pressure for two hours, apply a vacuum for one hour, and then inject 3 per cent zinc chloride solution until an absorption of one-half pound of dry salt per cubic foot (about 16.7 lb. of solution) was obtained. A pressure of 150 lb. was usually required for about four hours to secure this absorption. The solution temperature averaged about 150 deg. F. during the pressure period. Air seasoned coast Douglas fir ties were treated in a similar manner, except that both a longer steaming period and a longer pressure period were used.

The object of the experiments was to determine methods of obtaining more economical and efficient treatments, and the influence of the following variables was studied in the tests: (a) solution temperature; (b) preliminary steaming; (c) treating pressure, and (d) length of pressure period.

Some preliminary runs were made in the experimental cylinder in January, 1923, but the complete experiments were not carried out in full until during May, June and July. After the effect of the different variables had been studied in the experimental cylinder, the results were applied to commercial treatments in one of the large cylinders at the plant. The tests were made on air-seasoned ties.

The ties were weighed immediately before and after treatment in order to determine the absorption, and measurements were made of each tie so that the volume could be computed. All steam treatments were made at 20-lb. pressure (259 deg. F.). A preliminary vacuum was applied for one hour in all of the treatments in the experimental cylinder, after which the zinc chloride solution, heated to the required temperature, was admitted and pressure applied at once.

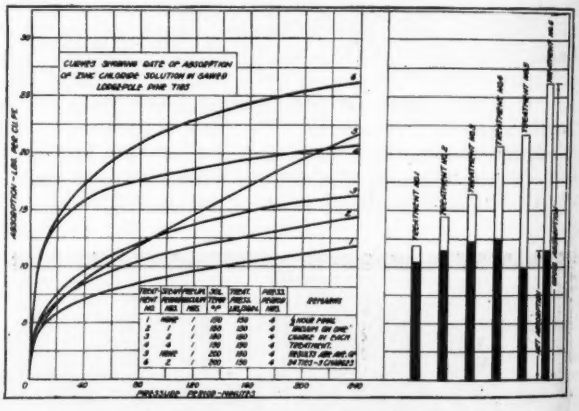

CURVES SHOWING RATE OF ABSORPTION OF ZINC CHLORIDE SOLUTION IN SAWED LODGEPOLE PINE TIES
ABSORPTION - LBS. PER CU. FT.
PRESSURE PERIOD - MINUTES
TREATMENT NO. 1
TREATMENT NO. 2
TREATMENT NO. 3
TREATMENT NO. 4
TREATMENT NO. 5
TREATMENT NO. 6

Fig. 1.—Results of Treatments 1 to 6, Table 1-A, on Sawed Lodgepole Pine Ties

Treatments on Lodgepole Pine Ties in Experimental Cylinder

Treatments Nos. 1 to 4, inclusive, (see table 1A) indicate that preliminary steaming improved absorption and penetration and that the improvement was greater in the longer steaming periods. No visible injury from steaming was noted in the ties steamed for one and two hours; but ties steamed for four hours were badly checked, and

Treatment number	Preliminary steaming	Preliminary vacuum	Solution temperature	Treating pressure	Pressure period	Final vacuum[1]	Average weight per cu. ft. before treatment	Kickback	Solution recovered by final vacuum	Net absorption	Gross absorption	Average penetration in heartwood, measured from borings	No. of charges of ties treated	Total no. of ties treated
	Hrs.	Hrs.	°F	Lbs. per sq. in.	Hrs.	Hrs.	Lbs.	Lbs. per cu. ft.	Lbs. per cu. ft.	Lbs. per cu. ft.	Lbs. per cu. ft.	Inches		
A - Sawed ties														
1	None	1	150	150	4	1/2	33.5	1.3	0.6	10.4	11.9	3/16	3	24
2	1	1	150	150	4	1/2	34.6	2.7	0.6	11.5	14.4	1/4	3	24
3	2	1	150	150	4	1/2	33.3	4.1	0.5	12.3	16.5	5/16	3	24
4	4	1	150	150	4	1/2	31.4	7.7	0.7	12.6	20.7	5/16	2	16
5	None	1	200	150	4	1/2	32.8	11.6	0.06	10.0	21.7	7/16	3	24
6	2	1	200	150	4	1/2	32.7	14.7	0.05	11.6	26.3	7/16	3	24
7	1	1	200	150	5	None	33.9	11.3	---	12.9	24.2	1/2	3	24
8	None	1	200	150	6	None	33.7	10.8	---	13.0	23.8	1/2	3	24
9	1	1	175	175	5	None	33.2	12.6	---	11.8	24.4	7/16	3	24
10	None	1	175	175	6	None	33.7	10.5	---	13.2	23.7	7/16	3	24
11	1	1	150	150	5	None	33.7	1.6	---	12.7	14.3	5/16	2	16
B - Hewed ties														
1	1	1	150	150	4	1/2	31.8	1.5	0.4	18.4	20.3	---	1	7
2	2	1	150	150	4	1/2	32.4	2.5	0.9	19.2	22.6	---	1	7
3	4	1	150	150	4	None	33.3	5.0	---	20.0	25.0	---	1	7
4	None	1	200	150	4	1/2	32.5	8.6	2.7	15.8	27.1	---	1	7
5	2	1	200	150	4	1/2	34.4	9.6	0.2	21.6	31.4	---	1	7

[1] A final vacuum was applied on one charge only in the treatments indicated and for this reason the figures on the amount of solution recovered by final vacuum are for one charge of ties.

Table 1.—(A and B) Treatments on Air Seasoned Lodgepole Pine Ties in Experimental Cylinder

a number showed considerable collapse. The heartwood faces of hewed ties were also checked by the four-hour steam treatment (Table 1B), but no visible injury was noted in the sapwood. Apparently steaming at 20-lb. pressure for four hours is not practical for air seasoned lodgepole pine when the heartwood is exposed, but it is possible that longer steaming periods could be used satisfactorily on round timbers of this species.

Treatments Nos. 5 and 6 were made in the same manner as Nos. 1 and 3 except that the solution temperature was 200 deg. instead of 150 deg. F. Although in treatment No. 6 the two-hour steaming hastened absorption, the ties showed a tendency to check at the ends when seasoned afterwards.

This did not occur in ties treated at the same solution temperature without steaming. A comparison of the curves showing the rate of absorption (Fig. 1) indicates that if the pressure period in treatment No. 5 had been increased by an amount equal to the time required for steaming, the absorption obtained without steaming would have been fully as good as that obtained in No. 6.

From Fig. 1 it is evident that the "kickback," or amount of solution ejected from the wood after release of pressure, increased as the length of steaming period was increased and was also greater at the higher solution temperatures. For this reason the total or gross absorption and the penetrations, rather than the net absorptions, should be considered in making a comparison of treatments. It will be noted that the gross absorption was about 82 per cent greater in treatment No. 5, made at 200 deg. F. without steaming, than in No. 1, made at 150 deg. F., and about 31 per cent greater than that obtained in treatment No. 3. A similar comparison of treatments Nos. 3 and 6, in which the ties were steamed for two hours, shows that the gross absorption obtained with a solution temperature of 200 deg. F. was about 59 per cent greater than when the temperature was 150 deg. F.

Treatments Nos. 7 to 11, inclusive (Table 1A), were made in order to determine the effect of different solution temperatures and to compare the results obtained, first by steaming, and second by omitting steaming and substituting a pressure period increased to include the time required for the steaming process. From Table 1A and Fig. 2 it will be observed that the final results were practically the same. However, the substitution of a longer pressure period instead of steaming would be more economical of fuel.

Table 1B shows the results of several runs made in the experimental cylinder on hewed pine ties. These treatments correspond to Nos. 2 to 6 (Table 1A) made on sawed ties of the same species which were practically free from sapwood. Although the gross absorption was greater in the hewed ties treated at 200 deg. F., the kickback was sufficient to leave about the same net absorptions as were obtained at the lower temperature.

The regular cylinders of the Laramie plant had no heating coils, and in order to make treatments with

Treatment number	Preliminary vacuum period	Average solution temperature during pressure period	Average treating pressure	Pressure period	Final vacuum	Average weight per cu. ft. before treatment	Net absorption	Average penetration in heartwood measured from borings	No. of ties in tram load weighed and measured
	Hrs.	°F	Lbs. per sq. in.	Hrs.	Hrs.	Lbs.	Lbs. per cu. ft.	Inches	
Air seasoned hewed lodgepole pine ties									
1	3/4	150	170	4.5	1/4	32.7	15.1	3/8	32
2	3/4	175	165	3.5	1/4	35.2	15.9	1/2	35
3	3/4	190	160	3.0	1/4	35.2	14.4	3/4	34
Sawed Douglas fir ties									
4	3/4	185	170	3.0	1/4	35.9	15.5	1-1/8	40

Note: In treatments No. 2 and 3 the gage readings showed heavier kickback than was noted for charge No. 1. For this reason the gross absorptions in the high temperature treatments were greater in proportion than is indicated by the net absorptions.

Table 2.—Treatments in Large Cylinder

solution temperatures of above 150 deg. live steam was admitted to the solution in the cylinder before pressure was applied. A period of from 30 to 45 min. was required to raise the temperature from 140 deg. or 150 deg. to 200 deg. F., and the strength of the solution was increased to some extent before admitting it to the cylinder to correct for the diluting effect of the condensed steam. Hewed pine ties were used in these tests and one tram load was weighed and measured in each charge. Each tram contained from 32 to 35 ties.

and best penetrations were obtained in treatment No. 5, in which the solution temperature was 25 deg. higher and the treating pressure 25 lb. less than used in No. 4.

Treatment 4 in Table 2 gives data on the treatment of sawed Douglas fir ties in the large cylinder. Although the pressure was maintained for only three hours, the average net absorption was 15.5 lb. per cubic foot and borings showed that penetrations in the heartwood of the ties averaged from ¾ to 1½ in. deep. No measurement could be made of the gross absorption, but it is probable

Treatment number	Preliminary steaming	Preliminary vacuum	Solution temperature	Treating pressure	Pressure period	Average weight per cu. ft. before treatment	Kickback	Net absorption	Gross absorption	Average penetration in heartwood measured from borings	No. of charges of ties treated	Total no. of ties treated
	Hrs.	Hrs.	°F	Lbs. per sq. in.	Hrs.	Lbs.	Lbs. per cu. ft.	Lbs. per cu. ft.	Lbs. per cu. ft.	Inches		
1	None	1	150	150	4	33.9	0.5	13.4	13.9	about 1/2	2	16
2	2	1	150	150	4	33.8	0.6	13.1	13.7	about 1/2	2	16
3	None	1	200*	125	6	34.2	4.1	15.3	19.4	about 3/4	2	16
4	None	1	175	175	6	35.7	3.9	16.0	19.9	about 3/4	2	16
5	None	1	200*	150	6	35.8	6.8	16.4	23.2	about 7/8	2	16

*On account of cylinder and wood being cold the solution temperature was 150° to 165° at start of pressure period. The required temperature was reached in from 3/4 to 1 hour.

Table 3.—Treatments on Air Seasoned Coast Douglas Fir Ties in Experimental Cylinder

The results of these treatments are given in Table 2.

Treatment No. 1 was similar to that in use at the plant, except that the two-hour steaming was omitted. Higher solution temperatures were used for treatments Nos. 2 and 3. Before pressure was applied the solution was heated to 190 deg. or 200 deg. F., but the temperature dropped somewhat during the pressure period, so that the average temperatures were 175 deg. and 190 deg., respectively. Although the treating pressures were lower and the pressure periods shorter for treatments Nos. 2 and 3 than for No. 1, there was very little difference in the net absorptions resulting. The gage readings showed that the kickback, and therefore the gross absorption, was considerably greater in treatments at the higher temperatures. Borings also indicated that the penetrations were about twice as deep in ties treated at the higher solution temperatures.

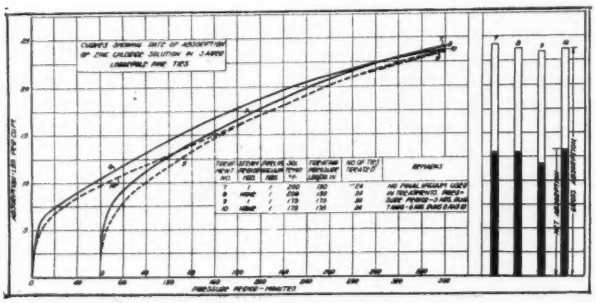


Fig. 2.—Results Obtained by Steaming Compared with Use of High Solution Temperature. Note Saving of Time by Latter Process

Treatment of Douglas Fir

Table 3 shows the results of treatments made in the experimental cylinder on Douglas fir ties.

Treatments Nos. 3, 4 and 5 show the effect of using different solution temperatures and different treating pressures. Although the pressure used in treatment No. 3 was 50 lb. less than in No. 4, the difference in pressure was apparently offset by the difference of 25 deg. in solution temperature. The heaviest absorptions

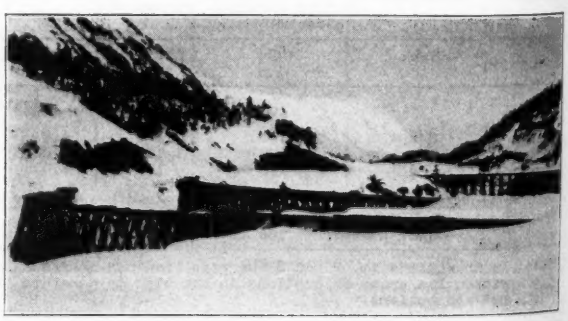
that with the solution temperature used the gross absorption was considerably greater than the net absorption.

Conclusions

The experiments at Laramie verified the results obtained in the Madison laboratory tests on Douglas fir and showed that the solution temperature is a very important factor in treating with zinc chloride. A comparatively small variation in solution temperature has a greater influence on penetration and absorption than a much greater proportional change in treating pressure.

Where the treating retorts are not equipped with heating coils, steaming preliminary to treatment is apparently useful as a means of heating the cylinder and the timber in the charge, at least for the treatment of refractory woods. The experiments indicate, however, that the higher solution temperatures are far more effective than steaming in the treatment of air seasoned lodgepole pine and Douglas fir, and it is reasonable to suppose that similar results would be obtained with other species.

The experiments made at Laramie showed that a very definite economy in treatment could be effected at the plant by omitting steaming and providing means of heating the solution to high temperatures. Savings can be accomplished through (1) reduced fuel consumption; (2) increased output per unit of plant equipment; and (3) longer life of the wood, afforded by better treatment.



The Loops on the Alaskan Railway

Hold Down the Cost of Shipping Company Materials*

A TOTAL of 11,460,919 tons of non-revenue or company freight, consisting of fuel and materials, was handled by the Illinois Central and the Yazoo & Mississippi Valley railroads in 1923. The cost per ton mile of hauling this freight was just as much as for revenue producing business, even though it was used in the maintenance and operation of the railroad.

Unfortunately the cost of shipping company material is often overlooked. Many officers and employes appear to feel that inasmuch as the road owns the cars and engines it makes little difference how much or how often company material is shipped. As a matter of fact the handling of company freight is a very important item of expense, as, aside from the expense of handling, cars used for company material mean cars diverted from revenue service.

Every effort has been made to impress the public with the importance of increasing car efficiency through maximum loading and prompt unloading. It is just as important that the light loading of cars with company material and delay in loading or unloading be avoided as with revenue freight, and we should certainly be able and willing to put forth every effort to go one better and practice the policy we preach to the shipper.

There is no denying the fact that there is much room for improvement in the manner of shipping company material and the maximum efficiency will never be attained as long as we persist in loading a few hundred pounds of scrap, a pair of wheels, an old hand car or a few pieces of timber on a car just because the car happens to be convenient and we want to get the material out of the way.

A great deal can be accomplished through anticipating material requirements by outlining a definite work program covering a period of several weeks or a month, cooperating with the store and other departments and shipping material for different departments but for the same destination or district in the same car. The spirit of cooperation can be carried still further by arranging with the yard master or agent to move and place the car promptly for loading or unloading and using every effort to see that there is no delay in handling.

The system of using peddler or transfer cars with mixed shipments consigned to several departments or supervisors is now in effect and is showing good results. There is still room for improvement, however, in the manner of handling these mixed shipments of material. For example, a car may have a frog for one track supervisor, some nut locks for another, pipe for the water works supervisor and nails or spikes or other material for the bridge and building supervisor. The material may or may not be plainly marked and where care is not used in showing the destination and consignee, the material often goes astray, causing needless delay and expense. Therefore, the following suggestions are offered to facilitate proper handling and delivery of material:

1. Tag each article with weatherproof tag.
2. Box or wrap all small articles in substantial packages.
3. Separate each shipment in the car.
4. Give each consignee a letter or wire stating the car number and date of shipment with request that the material be handled promptly.

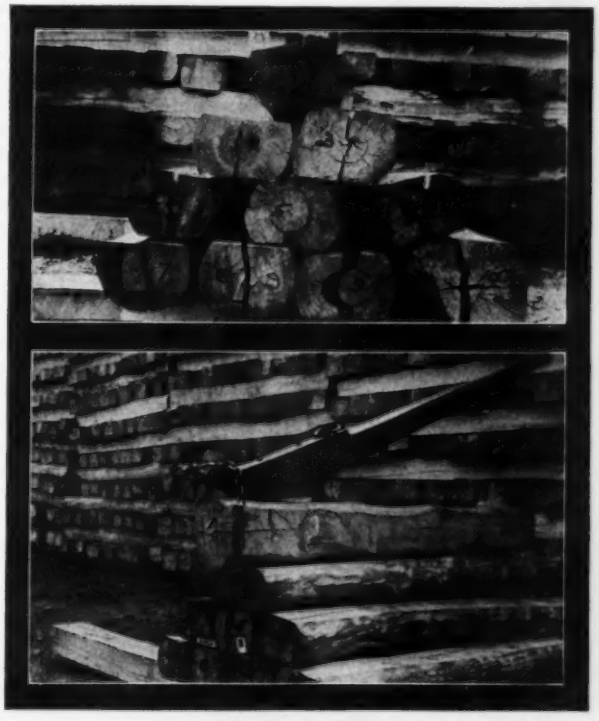
The practice of operating monthly supply cars by the store department has undoubtedly effected a marked reduction in non-revenue car mileage. Unfortunately these facilities are not always used to their full efficiency by either the supply department or the department supplied. Quite often supervisors, agents, pumpers and others fail to anticipate their full requirements in sufficient time to permit the materials to be handled by these cars, or, on the other hand, the supply department is not always prepared to fill the orders or substitute material that will be satisfactory, with the result that a special shipment is necessary by either baggage or freight.

It is very easy to fall into a habit of carlessness in shipping material. A little more attention to this important detail will result in material economies.

*From the Illinois Central Magazine for April.

Reclaiming Checked Ties

A SIMPLE device has been developed by the timber treating organization of the Northern Pacific for reclaiming badly checked ties in which the cracks are so wide that the S-Irons are of little use until the separated portions of the tie are drawn together. This device consists simply of a heavy oak timber. which is used as a lever with the aid of a log chain. The lever is 10 ft. long and 4 in. by 6 in. in section at the large end, and 2½ in. square at the small end. The large end is protected with an iron shoe. The chain is equipped with a logging hook which engages the links at any point to make a loop of whatever size is desired.

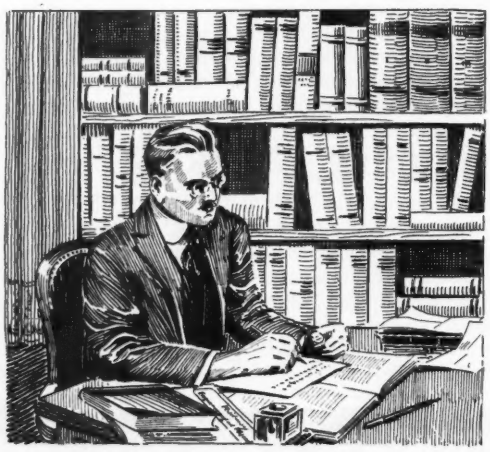


How the Lever Is Used and the Results Obtained With It

One of the photographs shows how this lever is used to press the parts of the tie together. When the splitting is great two men are required to operate the lever. The two photographs illustrate the results secured with this device. The ties are given the same numbers in each photograph so it may readily be seen how the splits have been closed up by the use of the lever and effectively held together by the S-Irons. The ties shown are illustrations of unusual checking; it is only the occasional tie which develops conditions requiring the use of the lever.

We are indebted for the above information to Andrew Gibson, superintendent timber preservation and tie treatment, Northern Pacific, Brainerd, Minn.

What's the Answer?



This department is an open forum for the discussion of practical problems of maintenance of way and structures. Readers are urged to send in any questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. *Railway Engineering and Maintenance* also solicits the co-operation of its readers in answering questions.

Questions to Be Answered in the June Issue

1. *When distributing gravel ballast for resurfacing and tie spacing after laying new rail, does it require less labor per mile to unload the ballast with center dump cars or with side dump cars?*
2. *Should the hoops of water tanks be loosened before painting the tub?*
3. *How large a stock of repair parts should be carried in stock by pump repair men?*
4. *Which is the more economical when building new second track parallel to the main line: to place the gravel ballast with side plows equipped with a long wing spreader and then place the new track on top or to lay the new track first and apply the ballast with center dump cars?*
5. *Should motor cars be equipped with gongs or other warning devices for use when approaching highway crossings?*
6. *What precautions and preparations should be made in the spring by bridge maintenance forces to prevent or prepare for damage to bridges and culverts as a result of flood waters?*
7. *To what extent should carpenters be expected to provide their own equipment and tools?*
8. *What is the best way to remove a tie?*

Vitrified Pipe for Highway Crossings

Is vitrified clay pipe to be recommended for installation under important highways at crossings?

First Answer

There are conditions under which vitrified clay pipe can be used safely. The important things to have are good foundations on which to lay the pipe and sufficient cover over it to decrease the load to a safe amount. The amount of cover necessary over the pipe depends on the diameter of the pipe. Pipe 12 in. or over in diameter should not have less than 6 ft. cover.

PAUL HAMILTON,
Assistant Chief Engineer, Big Four, Cincinnati, Ohio.

Second Answer

In the light of the present trends in highway traffic, the selection of culvert pipe for important highway crossings calls for careful discrimination. Therefore the suitability of vitrified pipe must be determined upon a study of local conditions. Such factors as available coverage for the pipe, the size of the culverts required, material of which the highway approach is built and the character of the foundation under the culvert are among factors which must be considered as well as the importance of the crossing. The relatively low initial cost of vitrified clay pipe naturally favors its use where other conditions will permit. This cost is frequently increased, however, by breakage occurring previous to its installation, a factor which is often the more appreciable in connection with highway crossing work than with more extensive work by reason of the less systematized care usually given to the smaller shipments.

There is also to be considered the breakage of the pipe in service by reason of the load imposed upon it and the strain to which it is subjected in the embankment. This is a factor of great importance in crossings on high embankments subject to extensive settlement or where the highway is paved, because of the large expense required to repair any damage that occurs. It is for the latter reason, chiefly, that the Pennsylvania uses no vitrified pipe under its roadbed. For a like reason vitrified clay pipe is not recommended under those highway crossings where the load imposed or the continuity of the traffic are comparable to that of the roadbed.

Except in such extreme cases, however, it may be stated as a general rule that, while not recommended indiscriminately for all highway crossings, vitrified clay pipe always deserves serious consideration. This pipe is used extensively at the present time on the Pennsylvania and is proving satisfactory where judiciously and properly installed. While it is true that highway crossings are subject to increasing loads, it is also to be remembered that clay pipe is being made of stronger sections for such service.

Under the more important crossings, however, it is important to see that the pipe is properly installed. Generally the pipe should be restricted to 18 in. in diameter with the coverage in no case less than 2 ft. It should be laid on a slope and should preferably have a slight hump in the center to provide for the slight settlement of the fill under service. It is frequently the practice to depend upon the backfilling to work its way under the pipe and furnish the support desired, although this usually gives rise to a condition where the load on the tile line is not uniformly distributed over its surface. When the crossing is a very important one and the foundation material soft or spongy, there is often justification in building a

grillage below the line or at least to lay the tile upon a mud sill extending lengthwise below the line of culvert. It is not the usual practice to seal the joints in installations of this character, but again, where the crossing is an important one, the cementing of joints is usually to be recommended as assisting in keeping the pipe in line and in distributing the strain. It is of particular value, moreover, where considerable water is conducted, in preventing any possibility of the water forcing its way out of the joint and scouring the foundation. With these precautions, notwithstanding the increasing loads on highways and the increasing importance of keeping them open, the answer to the vitrified pipe question would seem rather to be that of giving close attention to installation than to rule it out of consideration in specified cases.

T. W. PINARD,
Acting Assistant Chief Engineer, Maintenance of Way, Pennsylvania, Northwestern Region, Chicago.

Handling Motor Cars at Highway Crossings

What precautions should the operator of a motor car take when approaching a highway crossing?

First Answer

When approaching a highway crossing the operator of a track motor car should have his car under control, running at a speed that will permit him, if necessary, to bring the car to a full stop before reaching the crossing. He should make no attempt to adjust any part of the car when approaching a highway crossing but should observe the highway carefully for any vehicular traffic and not depend upon automobile drivers to stop. The operator of a track car should also be held responsible for any highway crossing accidents that he may become involved in. This will promote the care necessary on the part of the operator to guard against such accidents.

H. A. ADAMS,
Assistant to General Manager, in Charge of Safety, Union Pacific, Omaha, Neb.

Second Answer

I consider it essential for the operator of a motor car to bring his car under absolute control when approaching a highway grade crossing and to proceed only when the way is observed to be clear, notwithstanding the presence of any bells, whistles, horns or other warning devices with which the car or crossing may be equipped. There are altogether too many incompetent parties driving automobiles to permit taking chances at highway crossings, as is indicated by the fact that the majority of highway crossing accidents involving track motor cars have been due almost entirely to the fault of the automobile drivers. These drivers, moreover, in the majority of cases, are irresponsible parties, against whom the resulting damages of a collision cannot be collected. As a matter of safety all motor car operators on the Erie are instructed to make due allowance for these conditions and are held responsible in case of accidents.

H. KNIGHT,
Regional Engineer, Erie, Youngstown, Ohio.

Third Answer

In discussing this question, E. A. Greinke, a section foreman on the Chicago, Milwaukee & St. Paul, at Iron Ridge, Wis., enforces the following additional precaution: "When approaching a highway crossing where the traffic is so dense as to form practically a continuous line," said Mr. Greinke, "the operator should bring the motor car to a full stop and have one man go ahead and guard the crossing in the same manner as is done by a crossing watchman while the motor car is proceeding over the crossing."

Charles L. Vance, general foreman, Southern Pacific, Merced, Cal., goes one step further in recommending that the car should also be stopped completely wherever the view is obstructed and pushed over the crossing unless a man is sent ahead to ascertain if the road is clear enough to permit the operation of the car over the crossing.

Again, P. M. Bockke, a section foreman on the Great Northern, at Guthrie, N. D., emphasizes the importance of the motor car operator keeping in mind that the users of the highway invariably consider that they have the right-of-way over the motor car, and cautions against any attempt to "beat" vehicles of this sort over the crossing. He mentions the following experience to emphasize the importance of the latter. "When approaching a highway crossing one night while going home from work, I noticed two automobiles standing still about 10 ft. from the track while the drivers engaged in a conversation. I brought the car nearly to a stop about 100 ft. from the crossing but, seeing no signs of any intention on the part of the drivers to cross tracks, I started the car. When about 30 ft. from the crossing one of the drivers, suddenly discovering the motor car, got excied and swerved his car to the side with the result that the front wheels of the automobile became wedged between the planks and the rail, and a bad accident was avoided only by reason of the slow speed at which the motor car was traveling."

Storing Storm Windows

How and by whom should storm windows, stoves and other winter equipment be stored?

First Answer

On the Chicago & North Western it has been the practice to have practically all of this work come under the division supervisor of bridges and buildings. This was deemed essential because the men in this department are permanent employees who are familiar with such work. In order that this equipment will be kept in as good condition as possible, it becomes their regular duty to store it and I find they are very careful in doing so in order that when the time comes for replacing it for winter use all of the parts will be available. We experience very little trouble arising from the loss of parts or from damage to the equipment. D. ROUNSEVILLE,
Assistant Chief Engineer, Chicago & North Western, Chicago.

Second Answer

The suggestion was made in a recent report presented before the American Railway Bridge and Building Association that the handling of storm windows, stoves, etc., might advantageously be made a function of the painting gangs. Comments on this matter are reproduced as follows: "Painters are good mechanics and capable of doing other work in connection with their own. It has been suggested that some additions be made to the duties of the painting crews which would enable them to do other work when painting around the stations and which they could do more economically than other crews sent especially for that purpose. There is no doubt but that such a policy would bring about a noticeable improvement in the appearance of railway property in a few years and it would also be evident that the structures would be in better physical condition because of this attention. For instance, when a painting crew is working at a station the men could replace broken glass, as well as take down

stove pipes in the spring, clean and paint them and store them for use in the fall. In the fall they could take out window screens, clean and paint them and put them away ready for use in the spring. It is a well-known fact that window screens rust more rapidly when stored during the winter than they do while in use during the summer.

Synchronous Motors for Pumping Water

What is a synchronous motor? What are its advantages and limitations in pumping station service?

A synchronous motor is one which runs at a constant speed which bears a direct relation to the speed of the generator producing the current. A synchronous motor and generator thus run together like the two sprocket wheels of a chain drive mechanism or like two gears meshing with each other, the speed of one multiplied by the number of teeth being equal to the speed of the other multiplied by the number of its teeth. In the case of synchronous motors, the speed of the motor multiplied by the number of magnetic poles is equal to the speed of the generator at the power house multiplied by the number of poles of the generator. The result of this synchronous relationship is that there is no slip, as the term is commonly used in connection with machines. Instead, the motor is always "in step" with the generator.

The synchronous motor is distinguished from the induction motor. Induction motors of all kinds never run quite up to the synchronous speed, even without loads. Thus the product of the revolutions per second multiplied by the number of pairs of poles in the induction motor is always a little less than the number of cycles of the current per second, as produced by the generator. or the revolutions per minute of the motor multiplied by the number of poles of the motor are always a little less than the revolutions per minute of the generator multiplied by the number of poles of the generator. It is this difference that is called the "slip," a difference of five per cent thus resulting in a five per cent slip in the same way that a difference of five per cent between the speed of a motor and a machine driven by belt from the motor would represent a five per cent belt slippage.

The construction of a synchronous motor is in almost all respects like that of an altenating current generator. There is a stationary armature, and a revolving field or there may be a stationary field and a revolving armature. The fields are excited or magnetized by direct current rather than from alternating current which drives the motor, the direct current usually being obtained from a small direct current generator called an exciter. On account of their construction, which is more expensive than that of induction motors, and also because exciters are necessary, synchronous motors are usually made only in large sizes where the conditions under which they are used justify the extra first cost.

Synchronous motors are suitable for pumping station service only when the pumps start freely, as in the case of centrifugal pumps started with a closed discharge or against the normal working head. They may also be used for pumps of the displacement type, providing these pumps are operated through a by-pass line during the starting period so that the starting load is light. Usually synchronous motors are installed for pumping service only in large sizes, 50 hp. or over, or when the power company gives a reduced rate for such machines on account of the benefits derived from the improved power factor.

Where the work to be done at a pumping station is of sufficient amount to warrant the installation of a large motor and where, at the same time, the plant may be operated at a constant speed, the synchronous type motor is usually advantagous. In the first place, since it operates at 100 per cent power factor, it requires a generator of minimum capacity as against an induction motor which, in the same service, requires a generator of larger capacity. Aside from the economy arising from this characteristic, the synchronous motor may afford the added advantage of permitting its installation on a power line which would not carry an induction motor of the same capacity. A further advantage arises where the power line from which the motor is to be driven also furnishes current for a lighting system, which lighting might suffer considerable fluctuation if an induction motor were installed. A further advantage of the synchronous motor in pumping plant service arises where the power is generated. for example, by the company's own plant, which plant is of necessity already supplying current for several induction motors. In this case the installation of a synchronous motor at the pumping station will have the effect not only of operating the pumps but in so raising the "power factor" in the line as to diminish or eliminate the fluctuations in the line resulting from the operation of the induction motors. The ultimate effect of this is to improve the regulation of the central station service and increase the efficiency of the system.

M. O. SOUTHWORTH,
Electrical Engineer, Fairbanks-Morse & Company, Chicago.

Scheduling Track Joint Maintenance

Is it advisable to set aside a certain time each week or month for the maintenance of track joints?

First Answer

It is not advisable to set aside a certain time each week or month for the maintenance of track joints. Track joints require continuous maintenance. If a certain time was set aside each week or month for this purpose they would be neglected, receiving less care than should be given them.

L. COFFEL,
Supervisor, Chicago & Eastern Illinois, Momence, Ill.

Second Answer

Weather conditions are so variable in many months that it would be impracticable to specify certain days on which to raise joints. However, section foremen should be advised as to the number of days they should spend on this class of work for given periods and the work followed up closely to make sure that instructions have been correctly given and properly carried out. This year, the Chesapeake & Ohio is scheduling not only this work but all other work that is done on each section, the foremen being instructed as to the number of days each month he is allowed to spend on each class of work.

D. HUBBARD,
Division Engineer, Chesapeake & Ohio, Peru, Ind.

Third Answer

The maintenance of track joints is usually divided into two operations; (1) tamping the joints, and (2), tightening the bolts. The density of traffic and the character of the ballast and sub-grade will have a considerable bearing on the former. The type of bolt and nut used will determine the frequency of tightening required. It has been our experience that the tamping of joints should not be confined to any particular part of the month but rather to make such repairs as may be required from time to time, joints varying in their ability to resist the impact of the rolling load. They should be

tamped up promptly when they show a tendency to get low. As no one can tell when this condition will arise, it would appear to be better to correct the undesirable condition when it presents itself.

The necessity for tightening bolts has become less frequent since the introduction of the high elastic limit bolt and tight fitting nut (0.45 to 0.55 per cent carbon), with a thread pitch differential of one-tenth of a thread per inch of length, such bolts, when given two or three tightenings after laying rail, usually given little trouble thereafter. However, we have found that seasonal tightening of bolts by the section gang is good practice and is about all that is required with the new type bolts and nuts, best results being attained by doing this work in January and July. This, however, does not relieve the track walker from tightening such bolts as may become loose in the meantime.

J. C. WRENSHALL, JR.,
Engineer Maintenance of Way, Reading, Reading, Pa.

Sizing Trestle Deck Timbers Before Treatment

To what extent is it practical to size and bore trestle deck timbers before treatment?

First Answer

It is generally conceded that the cutting of creosoted timbers, as in cutting off the ends, in sizing or dapping to the required thickness or in boring for bolts or spike holes, comprises a practice which tends to defeat the purpose of treatment since it decreases the thickness or may penetrate entirely the shell of impregnated wood that protects the untreated material in the interior. In recognition of this approved practice requires that sway-bracing on bents be ordered to lengths that require no cutting and that shims be placed between bracing and piles where necessary to prevent any need for adzing the sides of the piles when applying the bracings to them. Of course, the tops of piles must be sawed off to receive the caps, but good practice calls for coating the pile tops with hot creosote and in using caps wide enough to cover the pile tops entirely.

When it comes to the deck the problem of avoiding cutting of the timbers becomes more complicated. Pile bents are not always driven to exact centers. Consequently, the panel spacing does not correspond exactly to that given on the standard drawings. This means that stringers having butt joints on the caps must be sawed to fit the bent spacing and that holes must be bored to fit, no matter what the arrangement of stringers. If the stringers are arranged with lap joints the need for cutting off the ends is entirely avoided.

Common practice calls for the sizing of stringers at their bearings on the caps for the purpose of securing a uniform top surface to receive the ties. Some roads, however, have found it entirely practicable to run stringers through a sizer to obtain this uniform thickness before the stringers are creosoted. Since it is not practicable to bore the holes before treatment the holes should be thoroughly swabbed with hot creosote before applying the bolts or drift bolts.

Ties can be sized for thickness readily and bored for both track spikes and bolt holes before treatment. Fenders or bond timbers, if dapped to fit over the ties, cannot very well be framed before treatment unless the ties are sized for width as well as thickness. However, experience has shown that it is not entirely practicable even in this case owing to the serious danger of breaking off a considerable number of the lugs in the course of the necessary handling between the creosoting plant and the bridge. Cross planking for ballasted deck structures, ordered to proper length should require no cutting in application to the structure.

Second Answer

In the past the Reading has done considerable framing of stringers for trestle decks, boring for packing blocks and splices, sizing the timbers as to depth of stringer, and squaring up one end before treatment. We have found that to cut stringers to exact lengths is very apt to cause trouble, as the spacing of pile and timber bents is not always exact, and a slight variation makes it very important that the stringers be received so that variations up to three inches in length can be met in the field.

It is our practice to cover the fresh sawed ends thoroughly with hot creosote. In several cases we have framed entire timber bridges, boring all holes needed in the finished bridge, and shipped the material to a creosoting plant. In the days before we had a creosoting plant of our own, this material was shipped to Long Island City for treatment and then returned to us. Bridges that were thus treated have been in use about 22 years, while several bridges built at the same time of untreated material, have had to be almost entirely renewed at the end of 12 to 15 years. This shows conclusively that no mistake was made in having the material creosoted after all framing and sizing had been done. We now treat all of the timber entering into important structures, with the result that we get from two to three times the service out of the material than from untreated timber.

Where planking is used on trestles the planking should be surfaced on one side to a uniform thickness, and where ties are used, daps should be made in them as required. The economies derived from this treatment more than amply repay for the additional money required for the treatment.

F. JASPERSON,
Assistant Chief Engineer, Reading, Philadelphia, Pa.

Best Wood for Highway Crossings

What are the best species of timber for use as crossing planks?

The best kind of wood for use in crossings is that which costs the least throughout its period of service. The selection for any particular kind of crossing depends on the traffic and the available supply of the woods which do not splinter readily.

For little-used crossings, durable woods like cedar, cypress, long-leaf pine, redwood, and walnut will wear long enough to get the advantage of the resistance of the plank to decay. For much-used crossings, non-durable woods like beach, birch, maple and gum might be used where they would be worn out within a few years, while white oak and red oak are suggested where the plank is worn out in about four and eight years, respectively.

Durability and wearability may be combined in treated wood. Creosoted gum plank provides a material for crossings which cannot be excelled, where it is to be had conveniently. Zinc treated plank of beech, birch, and maple should furnish a satisfactory solution of the crossing problem where other woods and creosote may not be available and where the wear makes renewals necessary in 10 to 12 years.

Wood laid with its grain vertical will wear longer than material placed as generally used in crossings, which

suggests that plank may not be the best form of lumber for crossing purposes. Better results are to be expected from flat-grain scantlings laid on their edges and bolted or nailed together than from flat-grain planks laid on their sides. The fastening of the former to the ties is more of a problem than the holding down of the latter, but it is a matter of no particular consequence. That difficulty is one reason why wood block has not been developed as a general crossing material. Blocks of wood with their cross-section exposed to the abrasion of traffic would make the most satisfactory crossings where naturally durable woods or woods made durable by creosote are available.

There is no universally "best species of timber for use as crossing planks." Along the Canadian border, northern white cedar and western red cedar are excellent under light traffic. In the Gulf states cypress and pine answer most satisfactorily under general conditions. In the lower Mississippi valley creosoted gum is better than any other where long service is required. White oak is suitable for most situations in the Appalachian section, though creosoted hardwoods would fit into many places where white oak is used through habit.

JOHN FOLEY,
Forester, Pennsylvania, Philadelphia, Penna.

Ventilating Ice Houses

Should ice houses be ventilated, and if so, what is the best method of doing it?

First Answer

The primary purpose of an ice house is the prevention of the transmission of a sufficient amount of heat to raise the temperature above the freezing point of water. Accordingly, if the outside air is below this temperature ventilation is not objectionable and can be effected with beneficial effects. When the outside air rises above this temperature any admission of such air into the house causes ice shrinkage. For this reason it is desirable to have only one entrance to the house and that of the minimum size.

The dead space above the ceiling installation and below the roof may be ventilated beneficially. The lower the temperature that is maintained in this space the less the shrinkage loss will be. The fact that ventilation of this space reduces the temperature is proved by observing any attic space in hot weather. The introduction of air into such a space by means of low level intakes cause an inflow of cooler air, thereby reducing temperature.

FRANK R. JUDD,
Engineer of Buildings, Illinois Central, Chicago.

Second Answer

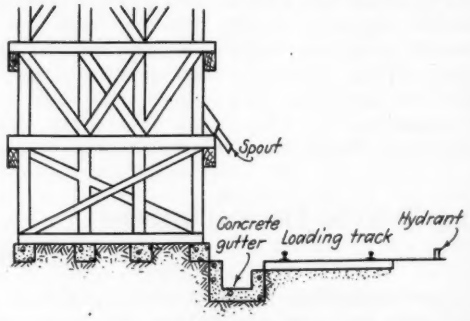
It is not considered good practice by the Pacific Fruit Express Company to ventilate artificial ice storage houses under refrigeration but it is considered important to stack the ice in such a manner that air will circulate between the ice and the wall and to provide a spacing of at least four inches under the stack for floor circulation.

In connection with natural ice houses where a ceiling is installed, ventilation is not considered necessary. In the old type of natural ice houses where no ceilings were present but where the top of the ice is kept covered with shavings, sawdust or swamp hay, it has been found economical to provide ventilators through the roof so as to prevent the accumulation of hot air in the top of the houses during hot weather. H. P. WHYTE,
Chief Engineer, Pacific Fruit Express Company, San Francisco, Cal.

Keeping Sand Loading Tracks Clean

BY R. FRANKLIN MUNDORFF

THE DERAILMENT of cars due to sand and gravel spilling over the loading tracks wherever they are handled is not uncommon, but it may be avoided by keeping the tracks clean with the aid of a gutter that may be constructed at small expense. This gutter can be built of concrete at either or both sides of the tracks with gravity drainage into any sort of waste basin or water pond. As a car of sand is loaded and moved to

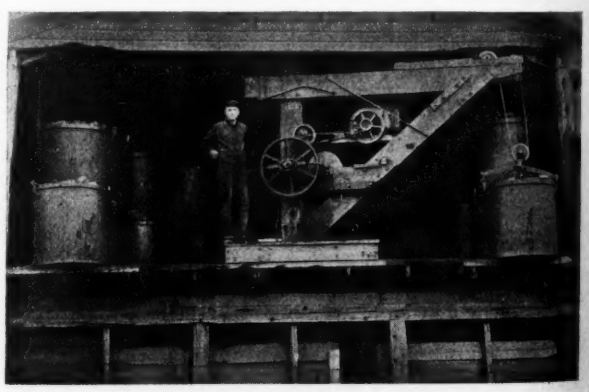


The Concrete Gutter Makes it Possible to Keep the Tracks Clean

the storage yard or down the track, the attendant can flush the track clean with a stream of water from a hydrant. The water and sand run into the concrete runway and thence to the waste water pond or outlet. This keeps the loading track clear at all times and prevents derailment due to sand lodging on the track. This system was devised and is used by the Flint Crushed Gravel Company, Des Moines, Iowa.

A Power Hoist for Loading Coal

AS A RESULT of injuring his shoulder, the attendant at a small coaling station on the Chicago, Burlington & Quincy, at Wilsonville, Neb., found it difficult to operate the hand crank of the hoist then used to elevate the coal for transfer to locomotive tenders. To overcome this difficulty, he mounted a 4 hp. Fairmont



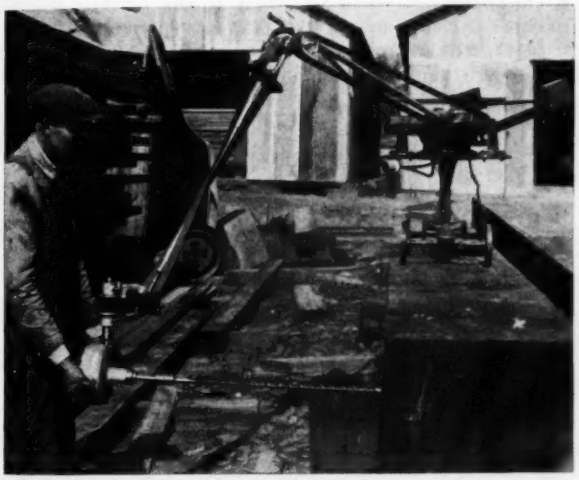
The Hoist in Use

gasoline engine in the triangular frame of the swinging crane and connected it to the hoist. As it is installed only two levers are required to operate it, these being the throttle and clutch controls. With this hoist the one attendant is able to handle 16 tons of coal daily. This arrangement was devised by Frank Coler, who is in charge of the operation of this plant.

New and Improved Devices

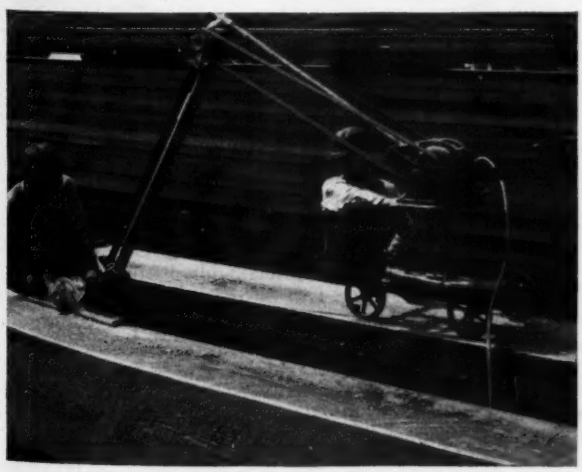
A Handy Machine for Carpenter Work

THE introduction of labor saving machinery in carpenter work has been exceedingly slow, not only as to timber bridge work but also as to building construction. However, by way of illustration of the mechanical equipment that is already available for such work, the general



Small Flexway Machine Used in Drilling Holes in a Big Timber

service tool described below is suggested as an interesting possibility, particularly in the light of the growing availability of electric current either from local public utility wires or from portable gas engine generator sets. The



Using the Flexway as a Planer

photographs show the adaptation of the portable wood-working machine to both drilling and planing, but it is equally applicable to gaining or dapping or to cut-off or rip sawing for outside work and when installed in a wood-working shop, can be applied to a large part of the operations required in mill work.

As seen in the photographs, the machine consists of an arbor designed to take any wood-working tool, mounted on a counterweighted, pivoted arm which is belt-driven from an electric motor supported on a swiveling frame which is in turn mounted on a four-wheel carriage. The machine is thus moved readily from place to place to meet the requirements of the work and can also be moved along as the work progresses, as when ripping or planing a long timber.

The machines are available in four sizes with motors ranging from 1½ to 7½ hp. The two larger sizes, which are more adaptable to heavy carpenter work, will cut through 8 in. and will drive a cutter head cutting 3 in. deep and 3 in. wide. By turning timbers over they will readily rip and cut off timbers 12 in. thick.

These machines are known as the Flexway wood-working machines and are manufactured by the P. L. Billingsley Company, Cincinnati, Ohio.

A New Switch Lock

ONE of the most recent developments in track appliances is an automatic switch lock forming an integral part of the lever latch housing and which embodies some marked departures from and measurable improvements over previous endeavors at a practical development along this line. The device is equally applicable to ground throw and high switch stands, but for the sake of simplicity the description given below is limited to the installation for a ground throw stand.

The mechanism consists of only five parts, a casting which embraces the lock jaw and lock housing in one piece, the lock, the latch, a dog and a dog trip. The lock, latch, dog and trip may be easily removed from the housing at any time if necessary for any reason. The latch and the trip hang from a pin that passes through the housing and are so balanced that they normally project into the jaw space provided for the switch lever. The latch projects above the top of the switch lever after it has been thrown home and is securely held in this position by the dog which occupies a position above the lock inside of the housing.

The operation of the lock is as follows: The key is inserted in the lock and given a half turn. This raises the dog which releases the latch and allows the switch lever to be removed from the jaws, the latch and trip swinging back into the jaw space as soon as the switch lever has been removed. The key is then turned to the locked position which allows it to be taken out of the lock but this operation does not lock the latch in the fixed position

because the trip, when projecting into the jaw space, holds up the dog so that it cannot lock the latch. As a result, it is possible to throw the switch lever back into the jaws without making it necessary to put the key back into the lock. As soon as the switch lever is seated it pushes the trip back, which in turn trips the dog and locks the latch securely in place.

It may be readily seen that this arrangement is a particular advantage in handling trains in and out of passing tracks. As a train approaches the switch the head brakeman opens the lock with his key, throws the switch and removes the key. After the train has passed through and

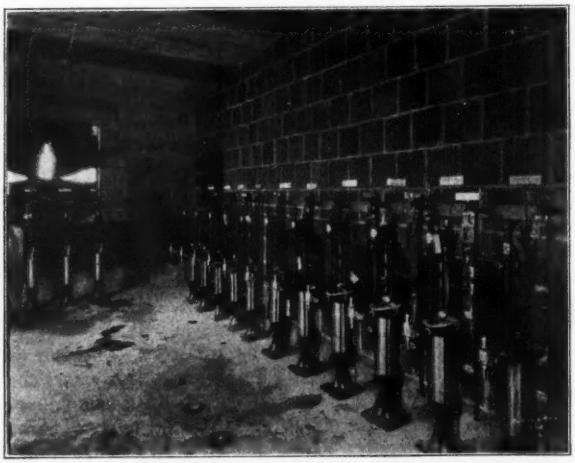
The K-A Lock on a Ground Throw Stand

cleared the switch, the rear brakeman reverses the lever to line the switch for the main track and as soon as he has pressed the lever down firmly into the jaws it is securely locked in place.

This device is manufactured by the Kellog Alquist Railway Service, Chicago, and is known as the K A automatic safety switch lock.

The Passing of the Oil Tank

MANY evidences point to the probability that the near future will see the almost total elimination of the use of the familiar cans for measuring or handling oil at storage or distributing points, at least where oil is used in any considerable quantity. These indications are borne out in the new oil house recently built by the Chicago, Burlington & Quincy at Denver, Colo. Instead of a battery of oil tanks, equipped with spigots, and a varied assortment of cans on the floor the oil distributing room at this plant contains only a series of neatly arranged measuring pumps, each drawing from oil tanks situated out of sight below the floor.



Interior of the New Burlington Oil House at Denver, Showing A Battery of Self-Measuring Pumps for Filling Oil Cans

These pumps are self-measuring and are of five gallons capacity each. The process of filling cans of oil consists simply of slipping the handle of the can over a rack provided for the purpose so that the spigot of the pump enters the opening in the can whereupon the oil is pumped by turning the handle. While the pumps are not new in type the installation is of special interest by reason of the large number at the one station and the total absence of the typical quart and gallon measures. Aside from the economy in the use of oil afforded and the means of keeping a more accurate record of oil distribution than is possible by less primitive means, these pumps were installed as a precaution against fire. They are products of the S. F. Bowser & Co., Ft. Wayne, Ind.

Reducing Clam Shell Bucket Upkeep

THE clam shell bucket is used so extensively in material handling operations that it has become less a problem of the manufacturers to enlarge its field of use than to make it more durable and reliable in its operation. A prominent weakness of this equipment has been in the opening and closing chains. Owing to the severe wear and shock to which these movable parts of the clam shell buckets are subject, considerable trouble has resulted from the breaking of these chains or the frequent renewals required for other reasons. To reduce the wear and thereby increase not only the reliability but the economy of clam shell operations, the Industrial Works, Bay City, Mich., has developed a shock absorber, which consists of coiled springs incorporated in the bucket-closing system between the bucket hinge and the end of the chains. Two of these coiled springs are placed on each bucket, each in a cage of strap iron, affording flexible connections at each end. Clam shells equipped with these shock absorbers have been in service for some time and have proved a decided help in reducing the shock and wear on the chains.

An Industrial Bucket Fitted with Shock Absorbers

Minwax Waterproofing Tested for Elasticity

DURING the last year comprehensive series of tests were conducted in the engineering laboratories of Columbia University on Minwax waterproofing fabric, manufactured by the Minwax Company, Inc., New York, for the dual purpose of determining the efficiency of this waterproofing under tension and also to determine how the amount of stretch in waterproofing membrane is affected by differences in the tensile strength of the fabric used.

It has come to be generally recognized that movements from temperature and loading strain or from settlements in structures impose the most severe strain on waterproofing. Obviously, this has made it important to determine the limits to which waterproofing can be stretched under various conditions without loosing its waterproofing qualities and at the same time to determine what bearing the membrane itself has in this respect.

The test specimens were made by first forming a concrete slab 6 in. wide, 20 in. long and 2 in. thick, which was then separated at the middle by cardboard strips to form two sections, each 6 in. wide and 10 in. long. When these blocks were 14 days old the upper surface of each block was mopped with molten asphalt and a piece of waterproofing fabric 6 in. wide by 20 in. long was applied. This fabric was then mopped with molten asphalt, another layer of fabric applied and this finished with a mopping of molten asphalt, the result of which was to build up a two-ply waterproofing membrane. After allowing the membrane to cool for 24 hours, a two-inch concrete slab of the same dimension as the lower one was poured on top and, as in the case of the first slab, it was divided into two separate parts. The result of this work was to produce a section of waterproofing identical to that applied in practice. Wood blocks having the same area as the concrete slabs were then applied on each side and compressed by means of coil springs so as to maintain an average pressure of 10 lb. per sq. in. upon the waterproofing membrane, this representing approximately the load which would come on the waterproofing membrane under average field conditions.

Altogether, 20 specimens were made, 10 using the Minwax specification membrane, the other 10 being prepared in the same way except that a membrane of different strength was used.

Summary of Tests

Kind of Fabric	Minwax Membrane	C-C Cloth Membrane
Average thickness of membrane...	3/16 to ¼ in.	⅛ to 3/16 in.
Weight of membrane per sq. ft.....	1.05 lb.	0.54 lb.
Breaking load in lb. per in. of width		
At room temperature.....	115	101
At freezing temperature.....	147	126
Average elongation in inches		
At room temperature.....	1.180	0.611
At freezing temperature.....	0.270	0.132

It is noticed that the Minwax membrane afforded an average elongation of 1.180 in. at room temperature before destruction and an elongation of 0.270 in. at freezing temperature.

It was considered significant that these tests gave results similar to tests made during the previous year on the Pennsylvania, the results in both cases indicating that the stronger fabric delivers a greater total strength and that the governing factor in the waterproofing under tension is the strength of the fabric itself rather than the strength of the completed waterproofing.

With the Associations

Roadmasters' Association

A meeting of the Executive committee of the Roadmasters' and Maintenance of Way Association was held at the Auditorium hotel, Chicago, on Tuesday, March 11, for the purpose of receiving reports from the chairmen of standing committees and to discuss the work being done in preparation for the convention in September. From reports received it was apparent that encouraging progress is being made in the committee work.

Bridge and Building Association

The engineering convention week in Chicago was also the occasion of a meeting of the Executive committee of the Bridge and Building Association, together with other members of the association who were present in Chicago at that time. A dinner at the Chicago Engineers' Club on Tuesday evening, March 11, resulted in a thorough discussion of the affairs of the association.

Maintenance of Way Club of Chicago

The renewal of ties was the subject of the meeting of the Maintenance of Way Club of Chicago held on Wednesday evening, March 19, at the Auditorium hotel, Chicago. An abstract of the stenographic report of this meeting appears on page 155 of this issue.

American Wood Preservers' Association

About 75 members and guests of the American Wood Preservers' Association met at dinner at the Builders' Club, Chicago, on Tuesday evening, March 11, to discuss the work of the association. The dinner was followed by an all-day meeting of the Executive committee for the purpose of selecting subjects for study and reports of the various standing committees at the next convention and for determining the personnel of these committees. Following is the summary of the committee assignments:

Preservatives.—Continue the study of oils or other toxics which are or might be suitable for wood preservatives, and the study of methods of creosote testing. Develop a visual penetration test for sodium fluoride and prepare revision of present standards of test. Prepare specifications and methods of analysis for petroleum suitable for admixture with standard preservatives. L. C. Drefahl (Grasselli Chemical Company), chairman.

Treatment of Ties.—Prepare a method of treatment with petroleum and creosote, petroleum and creosote coal-tar solution, and petroleum and zinc chloride. W. W. Lawson (National Lumber & Creosoting Company), chairman.

Treatment of Fir Ties.—Report on various methods of seasoning and treating Douglas fir. Prepare specifications for preservative treatment of Douglas fir cross ties, switch ties and bridge ties. H. E. Horrocks (Pacific Creosoting Company), chairman.

Treatment of Car Lumber.—Obtain statistics as to the quantity of lumber used in car construction. Define the restrictions and limitations as to uses and advantages of various standard preservatives which might be employed in treating car lumber. Co-operate with a committee to be appointed by the Mechanical

Division of the A. R. A. as to the immediate possibilities for the use of treated lumber in car construction and maintenance. Prepare specifications for preservative treatment of car material. C. M. Taylor (Central Railroad of New Jersey), chairman.

Treatment of Piling.—Prepare specifications for the preservative treatment of piling in line with accepted specification submitted at the 1924 meeting. H. S. Valentine (Eppinger & Russell Company), chairman.

Non-Pressure Treatment of Poles.—Report on progress and any new developments in open-tank treatment. Prepare specification for preservative treatment of poles by non-pressure process. J. D. Burnes (Page & Hill Company), chairman.

Plant Operation.—Report on the most economical method of handling ties; report on a feasible and practical method of separating cross-ties as received at the treating plants into the various sizes and groups as outlined in the A. R. E. A. specification for cross-ties. J. R. Helson (Watkins Creosoting Company), chairman.

Tie Service Records.—Extend the table of tie renewals for ties treated in 1923. Obtain additional records for 1923 from the reports of the Forest Products Laboratory. Give 1923 reports on special test tracks on six railroads. Prepare an outline of procedure for establishing test tracks, showing alternative methods by laying ties out of face and by spotting in as renewals. Z. M. Briggs (Pennsylvania System), chairman.

Posts.—Obtain data on covering the use of treated posts. Secure available information showing comparisons between treated posts, untreated posts, concrete posts, and steel posts. Secure from railways having test fence post sections the location of these sections, and opinions as to the relative value of the different posts. Suggest a standard method of reporting service records. Wm. Steen (Long Bell Lumber Company), chairman.

Steam Treatments.—Continue experiments on the effect of steaming and vacuum on the absorption and penetration in various species. Continue the study of the rate of heat transfer in wood. Study the effect of different steam temperatures and steaming periods on the physical condition of the wood. Obtain information on the effect of steaming on strength and also service records bearing on the effect of steaming on the serviceability of wood. Geo. M. Hunt (U. S. Forest Products Laboratory), chairman.

Directory of Associations

American Railway Bridge and Building Association.—C. A. Lichty, secretary, C. & N. W. Ry., 319 North Waller Ave., Chicago. Next convention Kansas City, Mo. October 14-16, 1924. Exhibit by Bridge and Building Supply Men's Association.

American Railway Engineering Association (Works in cooperation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn St., Chicago. Annual convention, Congress Hotel, Chicago, March 11-12, 1925. Exhibit by National Railway Appliances Association.

American Wood Preservers' Association—P. R. Hicks, secretary Room 1146 Otis Bldg., Chicago. Next convention, January 27-29, 1925, Chicago.

Bridge and Building Supply Men's Association.—John Nelson, secretary, Joseph E. Nelson & Sons, 3240 South Michigan Ave., Chicago. Exhibit in connection with annual convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers.—J. S. Penney, secretary, T. J. Moss Tie Company, St. Louis, Mo. Next convention, January 29-30, 1925, Chicago.

National Railway Appliances Association.—C. W. Kelly, secretary, Peoples Gas Bldg., Chicago. Annual exhibit at Coliseum, Chicago, in connection with convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—P. J. McAndrews, secretary, C. & N. W. Ry, Sterling, Ill. Next convention, Commodore Hotel, New York, September 16-18, 1924. Exhibit by Track Supply Association.

Track Supply Association.—W. C. Kidd, secretary, Ramapo-Ajax Corporation, Hillburn, N. Y. Exhibit in connection with convention of Roadmasters' and Maintenance of Way Association.

COAL FROM ALBERTA.—The Province of Alberta, Canada, produced in 1923, a total of 6,866,924 tons of coal, of which 63,557 tons was sold to the United States. About 2,000,000 tons was sold to other Canadian provincces and about 3,000,000 tons to railway companies. The total output was about 1,000,000 tons greater than in 1922.

The Material Market

THE market for materials still presents a confusing aspect. As far as prices are concerned the tendency is moderately downward. Thus far, this has not become generally manifest in the published quotations for iron and steel products, but there is every evidence that concessions are being made for large orders, contract prices for steel fabrication, for example, clearly evidencing that the fabricator is being protected by figures appreciably below those quoted for plain material.

This side of the picture is in distinct contrast to that presented by general business conditions. The production of iron and steel continues at a high rate while the general prosperity of the country is reflected in high records of weekly car loadings. Structural steel orders during March continued on an encouraging basis, but purchases of track materials have fallen off, indicating that a number of large orders, which have been pending, are being held up temporarily. Notwithstanding the general tendency the comparison of prices for February and March shown below indicates practically no change:

PRICES IN CENTS PER POUND

	February 20		March 20	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$3.05 to $3.15	.... to $3.10	$3.00 to $3.15	.... to $3.10
Track bolts	4.00 to 4.25	.... to 4.10	4.00 to 4.25	.... to 4.10
Angle bars	.... to 2.75	.... to 2.75	.... to 2.75	.... to 2.75
Tie plates, steel	.... to 2.60	.... to 2.60	.... to 2.60	.... to 2.60
Boat spikes	3.25 to 3.50	3.59 to 3.84	3.25 to 3.50	3.59 to 3.84
Plain wire	.... to 2.75	.... to 3.09	.... to 2.75	.... to 3.09
Wire nails	.... to 3.00	.... to 3.34	.... to 3.00	.... to 3.34
Barbed wire, galv.	.... to 3.80	.... to 4.14	.... to 3.80	.... to 4.14
C. I. pipe, 6 in. to 12 in., per ton	.... to	.... to 56.20	.... to	.... to 56.20
Plates	2.30 to 2.50	.... to 2.60	2.30 to 2.50	.... to 2.60
Shapes	2.40 to 2.50	.... to 2.60	2.40 to 2.50	.... to 2.60
Bars, soft steel	2.30 to 2.40	.... to 2.50	.... to 2.40	.... to 2.50
Rivets, structural	.... to 2.75	.... to 3.09	.... to 2.75	.... to 3.09
Reinforcing bars	.... to 2.40	.... to	.... to 2.40	.... to ....
Open hearth rail, per gross ton, f. o. b. mill				$43.00

After a slight advance in February the prices of scrap have again receded and are now lower than they were in January.

PRICES PER GROSS TON AT CHICAGO

	February	March
Relaying rails	$27.50 to $32.00	$27.00 to $32.00
Rails for rerolling	20.50 to 21.00	19.00 to 19.50
Rails less than 3 ft. long	22.00 to 22.50	20.00 to 20.50
Frogs and switches cut apart	19.50 to 20.00	17.50 to 18.00
Steel angle bars	20.50 to 21.00	18.50 to 19.00

The lumber market has also suffered a decline of which there is more tangible evidence in the quoted prices than in the case of iron and steel, since the tables shown below clearly indicate recessions from the prices quoted a month ago in most items. This is clearly the result of a curtailment of business, which the lumber dealers are inclined to ascribe to unfavorable weather throughout a large part of the country, winter conditions extending abnormally far into the south. The net result of this and other factors having an influence on the market has been a curtailment of orders. The Southern Pine Manufacturers' Association reports orders on hand on March 14 totaling 247,000,000 ft. b. m., as compared with 450,000,000 ft. b. m. on March 16, 1923. On the west coast orders during the first 10 weeks of 1924 aggregated 89 per cent of the total for the corresponding period of last year.

SOUTHERN PINE MILL PRICES

	February	March
Flooring 1x4, B and B flat	$46.20	$45.80
Boards, 1x8, No. 1	37.10	35.50
Dimension, 2x4, 16, No. 1, common	29.20	28.35
Dimension, 2x10, 16, No. 1, common	28.95	30.75
Timbers, 4x4 to 8x8, No. 1	30.90	30.65
Timbers, 3x12 to 12x12, rough	42.25	36.15

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear flat	$32.00	$32.00
Boards, 1x8, 6 to 20, No. 1, common	19.50	19.50
Dimension, 2x4, 16, No. 1, common	19.50	17.50
Dimension, 2x10, 16, No. 1, common	19.50	18.00
Timbers, 6x6 to 8x8, No. 1, common	26.00	23.00
Timbers, 10x10 to 12x12, rough	25.00	22.00

No changes have taken place in the prices of Portland cement except to make minor adjustments.

News of the Month

Retired employees of the Pennsylvania received a total of $3,698,036 in pensions during 1923, which was distributed among 7,376 employees. There are at present 31 persons on the list of pensioned employees who are 90 years of age or older. An analysis of the records show that the average employee renders about 40 years of active service. Since the inauguration of the pension plan in 1900, a total of $32,187,868 has been paid in pension allowances, during which period 16,406 employees have been retired.

There was recently completed on the Erie at Meadville, Pa., a freight house which was constructed entirely by money raised by the business men of the town, the railroads having taken no part in the enterprise except to furnish the plans and specifications and a building inspector to supervise the work. In the plan under which the construction was carried out the citizens paid for the building and leased it to the railroad at a rental that insures a fair return to the investors, the railroad agreeing to purchase the building at the expiration of 20 years.

The Missouri-Kansas-Texas has inaugurated what is probably the longest regular locomotive run in America, extending from Franklin, Mo., to San Antonio, Tex., a distance of 872 miles, over which a maximum train of 15 cars is handled without change of engines. The average speed of the train ranges from 35 to 43 miles an hour over track with a maximum grade of one per cent, except where the line leaves the Missouri river in Missouri and the Red river in North Texas, at which points the grade is 1.3 per cent. Helper engines are not required, however, on any of these grades.

Governor Smith of New York has sent a special message to the legislature urging the adoption of a constitutional amendment to enable the state to lend its credit to railroads and municipalities to pay for separating grades at crossings of highways with railroads, approximately one-half of all those in the state. According to his plan, if the state should furnish the $400,000,000 required for the purpose, one-fourth of this sum, according to the existing laws, would be a charge against the State treasury, the other three-fourths to be repaid by the railroads and the municipalities.

A new plan for promoting co-operative relations between the railroads and its employees has been introduced in an agreement reached by the Southern with its conductors and train and yard men, involving a three year wage agreement which provides not only for an increase averaging approximately five per cent in the basic rates of pay but establishes an additional community of interest through a plan by which the men are given an opportunity to earn a bonus through increased efficiency by helping to reduce those expenditures which are most directly influenced by their efforts.

Cash prizes of $500 and $100, were awarded to Martin A. Gembee, 118 Willoughby avenue, Brooklyn, N. Y., for the best poster and the most appropriate slogan, respectively, submitted in a contest conducted by the American Railway Association preparatory to launching an extensive campaign this summer to reduce the number of grade crossing accidents throughout the country. The winning poster carries the slogan "Wait—You May Lose" and shows an automobile which has been stopped beside a railroad track while a large locomotive pulling a heavy train speeds over the crossing. The poster is in yellow, red and black, showing the contrast between the heavy train and the light automobile. In addition to the first prize, there was also awarded a second prize of $200 for the second best poster and $100 for the third best poster. In making the awards the committee considered 5,000 posters made by artists in all parts of the country and more than 20,000 slogans.

Preparations have been started by the Howard Kenyon Dredging Company, Houston, Tex., to remove from the bottom of the Trinity river, near Liberty, Tex., 5,000 tons of rail which have been buried in four feet of mud since the Civil war. The rails were brought to Texas in 1858 for the purpose of building a railroad from Liberty, Tex., to Livingston, a distance of 52 miles. The work was interrupted by the Civil war and the rail was buried as a result of a change in the course of the river. Three attempts have since been made to recover the rails, the third about 15 years ago when a salvage organization succeeded in recovering 500 of them.

More than 50 per cent of the tonnage which can be moved either by water or rail from the eastern seaboard to the Pacific coast is now moving by water, according to testimony before the Senate committee on Interstate Commerce, which has been holding **hearings since February** 18 on a bill advocated by inter-mountain shippers. This bill is being opposed by the railroads as an attempt to settle a question which is now before the Interstate Commerce Commission whereby the transcontinental roads are seeking authority to meet water competition at the Pacific coast terminals without reducing their intermediate rates correspondingly.

The average number of employees on the Class 1 railways of the United States during the month of December, 1922, the last month of record, was 1,793,779, which was an increase of 9,189 or 0.3 per cent over the number reported for December, 1922. The returns for December, 1923, compared with those for the preceding month, show a decrease in the number of employees of 105,766, or 5.6 per cent, which appears principally in the maintenance groups. The total compensation decreased $15,024,016 or 0.6 per cent. The comparison of the cumulative returns for the 12 months of 1922 and 1923 shows an increase in 1923 of 14.3 per cent in employment and 14 per cent in total compensation.

A petition asking the Interstate Commerce Commission to reopen the proceedings in which it issued orders to 94 railroads to make installations of automatic train control has been filed with the commission by a committee of railway executives. The petition requests that the time for compliance with its first order directed to 49 carriers be extended for one year to January 1, 1926, and that the later order directed to the same roads and to 45 additional carriers be recalled, also that other modifications be made in the original order. All roads involved in the orders signed the petition excepting the Chicago, Rock Island & Pacific, whose installation has already been approved by the Commission, the Cincinnati, New Orleans & Texas Pacific, the Mobile & Ohio and the Southern. The railroads signing the petition take the position that no train control device has yet been installed which can properly be said to be more than an experiment or that can be said in advance that any of the devices, with possibly one exception, will meet with the approval of the Commission if installed. It is also contended that very large expenditures will be involved in complying with the order without knowledge as to whether the installation will be approved by the Commission when completed or whether the devices will function in such a way as to be a source of safety rather than a source of danger.

Personal Mention

General

W. H. Kilby has been appointed chief of forest protection of the Canadian National, with headquarters at Montreal, Que.

E. M. Durham, Jr., director of the Division of Liquidation Claims of the United States Railroad Administration, has been appointed assistant to the president of the Missouri Pacific, with headquarters at St. Louis, Mo. Mr. Durham was born on October 23, 1873, at Memphis, Tenn. He graduated from Lehigh University in 1896 and was engaged in the service of the United States War Department, making hydrographic surveys on the Ouachita river until 1899, when he entered railway service as a transit man on the Chicago & North Western. In 1900 he was appointed assistant engineer on the Southern, on which road he was successively promoted to resident engineer, principal assistant engineer, assistant chief engineer and chief engineer. He was appointed valuation engineer of the Atlanta, Birmingham & Atlantic in 1914 and a year later returned to the Southern as executive general agent. Mr. Durham was appointed manager of the department of way and structures of the United States Railroad Administration in 1920 and later was appointed director of the Division of Liquidation Claims. He continued in this position until his recent appointment as assistant to the president of the Missouri Pacific.

Engineering

W. R. Edwards of the valuation department of the Baltimore & Ohio, has been promoted to assistant maintenance engineer, to succeed **George W. Andrews,** deceased.

C. H. Campbell has been appointed assistant division engineer of the Logansport division of the Pennsylvania, with headquarters at Logansport, Ind., succeeding W. R. Triem who has been transferred.

F. A. Cellar has been appointed assistant division engineer of the Richmond division of the Pennsylvania, with headquarters at Richmond, Ind., to succeed **H. W. Brown,** transferred to the office of chief engineer maintenance of way.

L. G. Curtis, assistant chief engineer of the Baltimore & Ohio Chicago Terminal and chief engineer of the adjustment division of the Baltimore & Ohio, with headquarters at Baltimore, Md., has been appointed chief engineer of the Baltimore & Ohio Chicago Terminal, with headquarters at Chicago.

B. C. Ellis, assistant engineer on the staff of the engineer maintenance of way of the Illinois Central at Chicago, has been transferred to Louisville, Ky., to succeed **R. C. Williams,** who has been appointed supervisor of a newly created subdivision of the Louisville division, with headquarters at Central City, Ky.

R. L. Jolley, office engineer on the Nebraska division of the Union Pacific, with headquarters at Omaha, Neb., has been promoted to division engineer of the Nebraska division, with the same headquarters, to succeed **S. H. Osborne,** who has been transferred to the Los Angeles & Salt Lake, with headquarters at Los Angeles, Cal.

T. P. O'Neil, roadmaster on the Kansas, Oklahoma & Gulf at Allen, Okla., has been promoted to assistant district engineer, maintenance of way, of the Wyoming district of the Chicago, Burlington & Quincy, with headquarters at Alliance, Neb., where he succeeded **H. C. Murphy,** who has been promoted to district engineer of the Illinois district, with headquarters at Galesburg, Ill., succeeding E. F. Kultchar, resigned to accept service with another company, as noted in the March issue.

Mr. O'Neil entered railway service in 1900 as a track laborer on the Chicago, Burlington & Quincy. He was transferred to the engineering department as a rodman in 1903 and thereafter served consecutively as an inspector and as an instrumentman until 1908, when he left railway service. Returning to the Burlington in 1909, he was employed as instrumentman on construction until 1911, when he became instrumentman on the Kansas City Terminal. From 1914 he was consecutively recorder on valuation work on the Chicago & Eastern Illinois and as instrumentman on the Texas & Pacific until 1916, when he returned to the Burlington as assistant engineer in the valuation department at Chicago. He continued as assistant engineer on valuation until 1922, when he became roadmaster on the Kansas, Oklahoma & Gulf, as noted above.

J. R. Stubbins has been promoted to assistant engineer on the Wabash, with headquarters at Moberly, Mo., to succeed **R. P. Long,** who succeeds **R. D. Copeland,** with the same headquarters. **H. D. Pilcher,** supervisor of track, with headquarters at Montpelier, Ohio, has been promoted to assistant engineer, with the same headquarters, to succeed **E. N. Rchan,** resigned. **R. W. Kennedy** has been appointed assistant engineer at Peru, Ind., to succeed **D. B. Gillis,** resigned.

W. A. Greenleaf, whose promotion to division engineer on the Tampa & Gulf Coast, with headquarters at Tampa, Fla., was noted in the March issue, was born on January 22, 1885, at Elizabeth City, N. C., and was educated at North Carolina State College and Case School. He entered railway service in 1906 as a rodman on the Deepwater division of the Virginian, and thereafter served as pile recorder and bridge inspector and as assistant engineer on railway construction in Florida and North Carolina until 1910, when he left railway service. Thereafter he was engaged in private practice until 1916, when he returned to railway service as an assistant division engineer on the Florida division of the Seaboard Air Line at Tampa, Fla., in which capacity he was engaged until 1920, when he entered the service of the Tampa & Gulf Coast, being engaged as assistant engineer and roadmaster on this road and associated lines until his recent promotion to division engineer.

W. J. Bergen, consulting and valuation engineer of the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, has been promoted to chief engineer, with the same headquarters. Mr. Bergen was born on February 16, 1872, at Waterbury, Conn. He graduated from Rensselaer Polytechnic Institute, Troy, N. Y., in June, 1897, and entered railway service in May, 1899, as assistant to division engineer on construction with the Burlington & Missouri River, now a part of the Chicago, Burlington & Quincy, in Nebraska. In July, 1899, he was appointed levelman on location and in January, 1900, he was promoted to division engineer on construction. Mr. Bergen was appointed assistant engineer of the New York, Chicago & St. Louis, in July, 1901, and held this position until January, 1907, when he was promoted to chief supervisor of track. He was promoted to first assistant to the chief engineer in August, 1907, and to engineer in charge of grade elimination in December, 1916. In October, 1918, he was promoted to chief engineer, remaining in this position throughout the period of federal control. He was appointed consulting and valuation engineer in March, 1920, and continued in this capacity until his recent promotion to chief engineer.

W. J. Bergen

Track

H. M. Mann, supervisor of track on the Richmond division of the Pennsylvania, with headquarters at St. Louis, has been retired on a pension.

L. A. Cook has been promoted to acting roadmaster on the San Antonio & Aransas Pass, with headquarters at Cameron, Tex., to succeed **A. W. Wilmoth.**

George B. Hickok has been promoted to roadmaster on the First district of the Slaton division of the Panhandle & Santa Fe, with headquarters at Slaton, Tex., to succeed **E. R. Foster,** deceased.

R. D. Copeland, roadmaster on the Wabash at Moberly, Mo., has been promoted to supervisor of track at Montpelier, Ohio, to succeed **H. C. Pilcher,** who has been promoted to assistant engineer, as noted elsewhere.

J. W. Brozo has been promoted to roadmaster on the First district and the Canon City district of the Colorado division of the Atchison, Topeka & Santa Fe, with headquarters at Pueblo, Colo.

R. C. Williams, assistant engineer on the Louisville division of the Illinois Central, with headquarters at Louisville, Ky., has been appointed supervisor on a newly created subdivision involving new line, with headquarters at Central City, Ky.

Harry Withycombe, roadmaster on the Oregon Electric, has been appointed roadmaster on the Spokane, Portland & Seattle, with headquarters at Sallibridge, Wash., to succeed **T. J. Moriarity,** who has been transferred to the Astoria division to succeed **William Brown,** who has been transferred to the Oregon Electric.

John H. Olcott, incorrectly mentioned in the January issue as having been promoted to assistant supervisor of track on the Philadelphia & Reading (now the Reading Company), with headquarters at Philadelphia, Pa., was appointed assistant supervisor of track, with headquarters at Reading, Pa.

J. J. Galligan has been promoted to acting roadmaster of the Southern Pacific at Gila, Ariz., to succeed **E. Belch,** who has been transferred to Bowie, Ariz., to succeed **H. Collins,** who has been appointed roadmaster of the Deming district, with headquarters at Deming, N. Mex., in place of **W. F. Samson,** resigned.

Bridge and Building

J. L. Rippey has been appointed supervisor of bridges and buildings on the New York, New Haven & Hartford with headquarters at Taunton, Mass., to succeed **H. H. Kinzie,** deceased, as noted in the March issue.

L. F. McMaster, assistant bridge and building supervisor on the Nebraska division of the Union Pacific, at Omaha, Neb., has been appointed bridge inspector, and the office of assistant bridge and building supervisor has been abolished.

W. C. Corman, general carpenter foreman on the Pittsburgh division of the Pennsylvania, with headquarters at Johnstown, Pa., has been promoted to acting master carpenter of the Pittsburgh division, with headquarters at Liberty, Pa., to succeed **R. H. Helick,** master carpenter, who has resigned.

F. B. Helwig has been promoted to master carpenter on the Chicago, Rock Island & Pacific, with headquarters at Little Rock, Ark., to succeed **C. W. Eggers,** retired on a pension.

Obituary

Frederick Crossley, formerly construction engineer of the Canadian Pacific, died at his home in Keighley, Yorkshire, England, on February 26, at the age of 68 years. He entered the service of the Canadian Pacific in 1882, and in 1913, due to failing health, retired, to make his home in England.

E. B. Cushing, formerly chief engineer maintenance of way of the Southern Pacific, Texas and Louisiana lines, who retired in 1920, died at Houston, Tex., on February 17. Mr. Cushing was born on November 22, 1862, at Houston, and entered railway service in January, 1879. Subsequently he held various positions in the engineering department of the Southern Pacific until April, 1901, when he was appointed engineer maintenance of way of the Southern Pacific lines in Texas. In June, 1904, he was promoted to general superintendent of the lines in Louisiana and in 1917 was promoted to chief engineer maintenance of way the position he held until his retirement in September, 1920.

Construction News

The Atchison, Topeka & Santa Fe has awarded a contract to Sharp & Fellows Construction Company, Los Angeles, Cal., for the double tracking of 44 miles of its line between Summit, Cal., and Hicks, which will include the handling of 800,000 cu. yd. of earth and heavy rock excavation.

This company has been authorized to construct an extension from Marland, Okla., into the Tonkawa oil fields, a distance of approximately 10 miles, and contemplates improvements at its Richmond, Cal., yards, including new trackage and improvements to wharf facilities and shops.

This company has closed bids for the construction of an addition to the power house at Shopton, Ia., to cost approximately $15,000 and for the construction of an addition to the lunchroom at Syracuse, Kan., at a cost of $20,000.

This company has authorized the construction of a steel bridge over the Arkansas river at Arkansas City, Ark., at a cost of approximately $500,000. This company has about completed the survey of a proposed cut-off from Bakersfield, Cal., to Los Angeles.

The Baltimore & Ohio has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of a building, tank foundation, pump house and piping for a water treating plant at Connellsville, Pa.

The Beaver, Meade & Englewood plans the immediate construction of an extension from Forgan, Okla., to Hooker, a distance of 39 miles, at an estimated cost of $559,500.

The Boston & Albany has contracted for the construction of the baggage, mail and express portion of its passenger terminal development in Springfield, Mass. The cost of the work contracted for is estimated to be $600,000. The company has received bids on some trackage and bridge work between Niverville, N. Y., and Post Road Crossing, which work is in connection with the Hudson River Connecting Railroad and the Castleton bridge. The company is contemplating the replacement of dry ash pits at its Beacon Park (Boston) terminal with water pits and has under consideration the rebuilding of a number of railway and highway bridges.

The Canadian National has contemplated the construction of a grain elevator at Prince Rupert, Man.

This company has entered into an agreement with the Canada Creosoting Company calling for the erection and operation of a tie and timber treating plant at Truro, Nova Scotia.

This company has completed surveys for the construction of a branch line from Brule Lake, Alberta, to Grand Prairie, in the Peace river region.

The Canadian Pacific has announced a large program of extension and betterment work for the current year. Additional yard trackage will be constructed between Fort William, Ont., and Port Arthur to provide for the new terminal elevators at the head of the lakes. Considerable extensions will also be made to the terminal tracks at Ignace, Kenora, Outlook and Wynyard. Extensions will also be made to the existing trackage at Vermilion, Murillo, Fort Garry, Austin, Virden, Minnedosa, Johnston, Bredenbury, Antler, Tuxford, Cluny, Kirkpatrick, Kneehill, Milk River, Spring Coulee, New Dayton, Calgary, Coleman, Bank, Temple, Duthil, Nisku, Ottertail, Misko, Salmon Arm, Nutchill, Grind Rod, Okanagan Landing, Beavermouth and Vancouver.

Passing tracks, industrial tracks and yard extensions will be built at Chesterville, Tay, Lake Shore Junction, Point au Baril, Cache Bay, White River and Heron Bay in Ontario. To handle heavier locomotives a number of steel bridges will be replaced on the Havelock sub-division.

Extensions will be made to the engine houses at Outlook and Wynyard, and the mechanical facilities will also be improved at Medicine Hat. At Winnipeg the power house at the main terminal will be completely replaced by one of the most modern design. The station power plant at Calgary will also be remodeled. A Y. M. C. A. building will be erected at Ignace. Station work will include a new station and di-

visional headquarters at Schreiber, Ont., and grain handling facilities at Port McNicoll, Ont.

The Central of Georgia will spend between $5,000,000 and $6,000,000 in practically rebuilding its line from Birmingham, Ala., to Columbus, Ga. (157 miles), and a contract for this work will be let about April 1. These improvements will include the elimination of 40 highway and two railway grade crossings, 83 curves and the reduction of the maximum grade for eastbound traffic.

This company has applied for authority for the construction of 47.55 miles of new or diverging line between Opelika and Sterretts, Ala., as a part of a revision of alinement and grades on 100 miles of the Columbus-Birmingham line, which will reduce the mileage by 4.33 miles and, it is estimated, will reduce the cost of service by over 6 per cent on the investment. Approximately half of the work will be new or diverging line adjoining the present line.

The Chicago, Burlington & Quincy plans the construction of an addition to the roundhouse and extensions to the yard tracks at Gibson, Neb., at an estimated cost of $170,000, and has rejected bids for the construction of a roundhouse at Denver, Colo., with the expectation of calling for new bids in the near future.

This company will construct a car repair shop and additional terminal trackage at Galesburg, Ill. It has awarded a contract to Harvey Wood, Aurora, Neb., for the construction of a five-stall roundhouse at Edgemont, S. D., and has awarded a contract to Frank Jacoby & Sons, Billings, Mont., for the construction of an addition to a hotel and eating house at Cody, Wyo.

The Chicago, Indianapolis & Louisville is asking for bids for the construction of a frame passenger station, 20 ft. by 40 ft., at San Pierre, Ind.

The Chicago, Rock Island & Pacific has authorized the construction of extensions to second and third main tracks this year at a cost of $425,000. Grade separation work at Burnside, at a cost of $350,000, has also been approved.

This company has authorized the construction this year of passenger stations at Iowa Falls, Ia., and Tucumcari, N. Mex.; a freight station at Wewoka, Okla.; improvements to passenger stations at El Dorado, Ark., and Hot Springs; coaling stations at Peoria, Ill., Hutchinson, Kan., Dalhart, Tex., and Melcher, Ia.; a water station at St. Albans, Mo., and power plants at Armourdale, Kan., Herington and Horton.

The Cleveland, Cincinnati, Chicago & St. Louis plans the construction of a passenger station at Sidney, Ohio, and will soon call for bids for the work. This company also contemplates the construction of an engine terminal at Cincinnati, Ohio, but has not yet completed plans.

The Esquimalt & Nanaimo has appropriated $250,000 for improvements, which include the placing of steel flanking spans on several steel bridges; the renewal of three large steel trestles, and the filling of structures where the Esquimalt & Nanaimo joins the Island Highway at Victoria, B. C.

The Florida East Coast will begin immediately the double-tracking of its line between Jacksonville, Fla., and Miami (366 miles). The company will also build a 19-mile belt line around the city of Miami in order that freight traffic may be moved around, rather than through, the congested urban area.

The Great Northern has called for bids for the construction of a steel coaling station of 500 tons capacity at St. Paul, Minn.

This company has authorized reductions in grade between Scotia, Idaho, and Newport, a distance of eight miles, and at Sandpoint, Idaho, and additional yard tracks at Sandpoint, at a total cost of $150,000. The construction of a pumping plant and water supply system, including a 100,000-gal. water tank at Hillyard, Wash., has also been authorized.

The Gulf, Colorado & Santa Fe has awarded a contract to the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., for the design of rock-crushing plant and the installation of machinery at Hall Mountain, Texas, near Brownwood, which the company is moving from Coleman. The grading has been contracted to T. A. Griffin, Dallas, Texas, and the concrete work to Martin and Nicholls, Dallas, Texas. The plans of the crusher plant include the installation of one No. 8, one No. 6 and one No. 5 type "K" crushers, operated by steam power.

The Hampton & Branchville Railroad & Lumber Company has applied to the Interstate Commerce Commission for authority to construct an extension from Smoaks to Summerville, S. C., of which it is proposed to build only 12 miles, from Smoaks to Canadys Cross Roads, at this time.

The Illinois Central plans the construction of a mail terminal at Memphis, Tenn., to cost approximately $250,000.

The Louisville & Nashville is calling for bids for the construction of a two-story brick freight station at Covington, Ky., reported in the November issue, and plans the construction of shops, a roundhouse and other terminal facilities at Leewood, northeast of Memphis, Tenn., at an estimated cost of $500,000.

The Mississippi Southern plans the construction of a 14-mile extension from Kiln, Miss., to Pass Christian, where it will connect with the Louisville & Nashville.

The Missouri Pacific is asking for bids for the construction of a pipe line consisting of 4,000 ft. of 8 in. and 275 ft. of 12 in. cast iron pipe at Texarkana, Ark.

This company has awarded a contract to the Kellermann Contracting Company, St. Louis, Mo., for the construction of an addition to the storehouse at Ewing avenue, St. Louis, Mo., and will rebuild at once its machine shop and power house at Monroe, La., recently damaged by fire with a reported loss of $100,000.

The New York, Chicago & St. Louis plans the construction of a concrete coaling station at Cleveland, Ohio, also the construction of an addition to its roundhouse at Sharonville, Ohio.

The Nevada-California-Oregon has applied to the Interstate Commerce Commission for a certificate authorizing the construction of an extension from Lakview, Ore., north for a distance of 6 miles.

The Oregon-Washington Railroad & Navigation Company has been authorized to construct and operate in common with the Walla Walla Valley a branch line of three miles to the village of Umapine, Ore.

The Pennsylvania has prepared plans for two new freight houses at Cincinnati, Ohio, as reported in the March issue. The buildings will be of brick and steel construction and one story in height. They will be erected on foundations which were constructed before the war, but on which work was abandoned during the period of federal operation. Construction will begin in March. The estimated cost is $300,000.

The Prescott & Northwestern plans the construction of a 26-mile extension from Prescott to the Nevada county, Ark., oil fields.

The Reading has awarded a contract to the Curtis-Grinrod Company, Philadelphia, for the construction of a new station with platforms, shelters, drives and walks at Fern Rock, Pa. The company has also awarded a contract to the Smith-Callahan Company, Bala-Cynwyd, Pa., for the construction of a highway at West Manayunk, Pa., which will eliminate a highway bridge over its tracks.

The Rio Grande City has applied to the Interstate Commerce Commission for authority to construct a line from Sam Fordyce to Rio Grande City, Tex., 22 miles. J. B. Carrington, San Antonio, Tex., is secretary-treasurer.

The Santa Fe & Northwestern plans the construction of a line from La Ventana, N. Mex., to Farmington, a distance of 100 miles; a 16-mile branch line from San Ysidro, N. Mex., and a 12-mile branch line from La Ventana to Cuba. The Cuba Extension railroad, a subsidiary of the Santa Fe & Northwestern, is now constructing a 44-mile line from San Ysidro to Cuba. Sidney M. Weil, Albuquerque, N. Mex., is promoting the enterprise.

The Seaboard Air Line is contemplating the revision, enlargement and modernization of its team track facilities at Atlanta, Ga. Several extensions of industrial spur tracks, varying from one to two miles in length in Georgia and Florida, are also planned. A new freight station and team track facilities are contemplated for Orlando, Fla.

The Southern will build a 17-mile cut-off from Bulls Gap, Tenn., on its Knoxville-Bristol line to Leadville, Tenn., on its Morristown-Asheville line. Contract for grading and masonry has already been let. The new line will save a haul of 11.5 miles in the haul from Bulls Gap to Asheville and will provide much easier gradients for the coal traffic moving from the Southwest Virginia fields to Carolina territory.

This company has been authorized by the Interstate Commerce Commission to construct an extension of 2.93 miles in the city of Knoxville, Tenn.

This company will soon award contracts for the construction of modern engine-handling facilities at Spencer, N. C., the junction point of the Charlotte, Danville, and Asheville divisions. The new facilities will include a 37-stall roundhouse with annexes to accommodate a small machine shop and a foreman's office; a flue and engine shop; a 100-ft. turntable; two engine inspection pits 100 ft. long; and a crane runway 320 ft. long to accommodate a 10-ton traveling crane with a 25-ft. span, to convey heavy parts from the new roundhouse to the flue, babbitt and machine shops. The roundhouse will be 106 ft. deep, of reinforced concrete and brick construction with steel windows and hollow tile roof.

This company has awarded a contract to W. Toelle, Princeton, Ind., for the construction of a planing mill at Princeton, reported in the February issue.

The Southern Pacific has awarded a contract to the Utah Construction Company, San Francisco, Cal., for the construction of a tunnel, two miles long, between Lake View, Cal., and the summit of the Sierra Nevada Mountains.

This company, jointly with the Pacific Electric, has purchased land near Watson Station, Cal., on the Los Angeles Harbor Line, upon which to construct a freight classification yard with a capacity of 5,000 cars. The construction is estimated to cost $1,750,000.

The Spokane & Eastern plans the construction of a steel girder span over the tracks of the Oregon-Washington Railroad and Navigation Company at Garfield, Wash., at a cost of $15,000.

The Temiskaming & Northern Ontario is planning improvements throughout its system from North Bay to the northern terminus at the end of steel north of Cochrane, according to an announcement made at North Bay by George H. Lee, chairman of the Ontario Government Commission, which directs the road. The largest item will be the replacing of 40 miles of 80-pound steel between North Bay and Englehard with 90-pound steel, of Canadian manufacture. This work will commence on April 15. Tie replacement will be general throughout the entire road, it being planned to lay 175,000 ties this year. Much ballasting will be done and the Kirkland Lake branch line will be completed.

The Tucson, Phoenix & Tidewater has been granted a 25-year franchise to construct and operate a railroad through Maricopa county, Arizona, by the County Board of Supervisors. The Tidewater Main Line Association has been organized at Phoenix, Ariz., to urge before the Interstate Commerce Commission the railroad's application for a permit to build from Tucson to Phoenix.

This company has purchased land at Phoenix, Ariz., as a site for a passenger and freight station.

The Union Pacific received bids on March 10 for the grading, bridges, culverts and fencing of an extension from Fort Collins, Colo., to a point 17 miles north. The line will have a maximum grade northbound of 1.25 per cent and southbound of 0.65 per cent. The maximum curvature is 3 deg. The company expects to complete the work this summer.

The Wabash plans the immediate reconstruction of its shops at Decatur, Ill., which were recently destroyed by fire at a loss estimated at $1,000,000.

This company plans the construction, jointly with the Canadian National, of a roundhouse and locomotive repair shops at St. Thomas, Ont., also the construction of additions to its machine shop at Moulton, Iowa, which will double its capacity.

The West Australian Government Railways has awarded a contract to the Roberts & Schaefer Company, Chicago, for the installation of a coaling station at Freemantle, West Australia.

Supply Trade News

General

The Kelly-Derby Company has moved its office from the Peoples Gas building to its factory and warehouse at 321-3 North Crawford avenue, Chicago.

The National Railway Appliances Association has moved its office from the Peoples Gas building to the Seeberger building, 845 South Wabash avenue, Chicago.

The Truscon Steel Company, Youngstown, Ohio, has leased a building at Erie and St. Clair streets, Chicago, to which it will move its Chicago offices on May 1.

The Pawling & Harnischfeger Company, Milwaukee, has purchased from the receivers the entire property of the Hercules Steel Castings Company, Milwaukee, and will operate the plant about May 1.

The McMyler-Interstate Company, Cleveland, Ohio, has opened a new branch office at 619 Genesee building, Buffalo, N. Y., in charge of J. E. McFate, Buffalo district representative.

This company has moved its Chicago office to 648 Railway Exchange Building.

The Hattiesburg Creosoting Company has purchased the plant of the Southern Creosoting Company, Slidell, La., and will continue its operation with practically no change in the operating force. The main office of the Hattiesburg Creosoting Company will remain at Hattiesburg, Miss. The Hattiesburg Creosoting Company, with the acquisition of the Slidell plant, will now have an annual capacity of 70,000,000 ft. board measure.

The Blaw-Knox Company, Pittsburgh, Pa., has adopted an extended payment plan available to all purchasers of its line of standard steel buildings which is designed to simplify the financing of projects for the construction of shops, warehouses, and other industrial structures. The standard terms under the building-finance plan provide for a 10 per cent payment with the order and 23⅓ per cent on delivery, with the balance payable in monthly installments over a period of one year. Companies that prefer to buy buildings outright as heretofore are accorded a cash discount of 5 per cent.

The Portland Cement Association has made the following changes in its staff: **C. D. Franks,** district engineer in charge of the Indianapolis office at Indianapolis, Ind., has been appointed assistant general manager in administrative charge of the association work in the district enclosed by the offices at Minneapolis, Minn.; Milwaukee, Wis.; Des Moines, Ia.; Chicago; St. Louis, Mo., and Indianapolis, Ind. Mr. Franks' headquarters will be the Merchants Bank building, Indianapolis, until June 1, after which his headquarters will be at 111 West Washington street, Chicago. **L. C. Miller,** associate field engineer in Indiana, succeeds Mr. Franks as district engineer in charge of the Indianapolis office. **John E. Case,** heretofore district engineer in charge of the office at New Orleans, La., and previously association field engineer in North Carolina, has been appointed district engineer in charge of a newly established office in the Piedmont building, Charlotte, N. C.

The Wayne Tank & Pump Company, Ft. Wayne, Ind., has established an organization among the sales representatives of its water softening division, to be known as the Wayne H-2-O Club. Salesmen who have reached their sales quota are eligible for membership. The purpose of the club is to foster better salesmanship in the marketing of the company's products, to create a feeling of friendly rivalry between salesmen and the various district offices and to promote better understanding and co-operation between the field and office forces of the water softening division. Officers of the club will be selected on the basis of the volume of business during the year. The ten members of the board of directors will be those having the next highest volume of business handled. Each representative qualifying for membership in the club will be presented with a gold emblem and a diamond will be

mounted on the emblem for each successive year. Special awards will also be given annually for high volumes of business.

Personal

W. R. Toppan, manager of the railroad department of the Graver Corporation, with headquarters at Chicago, has resigned.

John W. Shoop, who has been associated with the Lehon Company, Chicago, for the past 15 years, has been appointed manager of railway sales.

H. L. Gilliam, heretofore district sales manager of the Wood Shovel & Tool Company, with headquarters at Norfolk, Va., has been placed in charge of its office at 50 Church street, New York.

L. Sparks, New England manager of the Erie Steam Shovel Company, has been appointed eastern sales manager of the Ohio Locomotive Crane Company, with headquarters at New York.

Herbert Mertz, secretary and sales manager of the Orton-Steinbrenner Company, with headquarters at Chicago, has been elected a director, succeeding H. G. Steinbrenner, resigned.

G. P. Rogers, general sales and advertising manager of the Pyrene Manufacturing Company, Newark, N. J., has resigned to become vice-president and director of sales and advertising of the Kant Rust Products Corporation, Rahway, N. J.

Elijah Bates, local manager of Haskins & Sells, public accountants, with headquarters at Cleveland, Ohio, has been appointed secretary and treasurer of the McMyler-Interstate Company, with headquarters at Cleveland, Ohio, succeeding H. H. Hammond, resigned.

Stuart J. Dewey, formerly assistant signal engineer of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Cincinnati, Ohio, and more recently engineer with the State Highway Commission of Pennsylvania, has been appointed sales engineer of the Truscon Steel Company, with headquarters at New York.

D. S. Price, an engineer with S. F. Bowser & Company, has been promoted to district manager in charge of the lubrication and filtration department, with headquarters at Detroit, Mich. **O. M. Tottom,** engineer, has been promoted to district manager in charge of the lubrication and filtration department, with headquarters at Indianapolis, Ind.

Tom G. Windes, manager of the railroad department of the International Filter Company, Chicago, has resigned to become general sales manager of the recently organized Aluminate Sales Corporation, Union Stock Yards, Chicago, distributors of aluminate of sodium, now being manufactured on a commercial scale for use in water softening. He was born on April 26, 1879, in Chicago and studied chemical engineering at the University of Wisconsin, graduating in 1902. He then entered the employ of the Pfister & Vogel Leather Company, Milwaukee, as a chemist, which position he held until the following year, when he entered the metallurgical laboratories of the Illinois Steel Company, Chicago. Later he was employed as a chemist in the Griffin Car Wheel Works until 1905, when he became associated with the Kennicott Water Softening Company, Chicago. He entered railway service the following year as a chemist in charge of water softening on the Vandalia (now the St. Louis division of the Pennsylvania), where he remained until 1909, when he returned to the reorganized Kennicott Company as manager of the railroad department. In 1916 he became Chicago representative of the L. M. Booth Company, New York, and after the absorption of this company by the Refinite Company, Omaha, Neb., in 1920, continued in the same capacity with the latter organization until July, 1921, when he entered the employ of the International Filter Company, Chicago, as manager of the railroad department.

Tom G. Windes

George Frank Konald, general manager and treasurer of the Warren Tool and Forge Company, Warren, Ohio, died in a hospital in that city on March 3, from complications following an operation. He was born at East Douglas, Mass., on June 25, 1864, and at the age of 15 entered the employ of the Iron City Tool Works as a hammerman's helper, later becoming a hammerman. He was employed in various positions in this plant for the following nine years, when, at the age of 24, he succeeded his father as superintendent of this plant. He held this position until December, 1911, when he became associated with the Warren Tool & Forge Company, which had been organized by his brother, M. J. Konald, and J. D. Robertson, and continued his connection with that company until his death.

George Frank Konald

T. F. Manville, president and treasurer of Johns-Manville, Inc., New York, was elected chairman of both the board and the executive committee at a recent meeting of the board of directors; **H. E. Manville,** vice-president and secretary, has been elected president; **L. R. Hoff,** general sales manager at New York, has been elected vice-president and general manager of the company; **W. R. Seigle** has been re-elected vice-president and general manager of the factories and mines; **J. E. Meek,** general manager of the railroad and United States Government department, and **J. W. Perry,** general manager of the electrical department; also **J. S. Carroll,** general manager of the oil industry department, have been elected vice-presidents. **A. C. Hoyt,** assistant treasurer, has been elected secretary and treasurer, and **T. F. Manville, Jr.,** has been appointed assistant secretary, all with headquarters at New York. The members of the newly elected executive committee are T. F. Manville, H. E. Manville, L. R. Hoff and W. R. Seigle.

Mr. Meek was born at State College, Pa., and prior to 1888 served seven years with the Pennsylvania Railroad at Altoona, Pa., shops, following which he went to Denver, Colo., where he remained for six years, the last three years of which he was chief engineer of a power plant. He entered the employ of the H. W. Johns Company, New York City, in 1904, and went with the new organization of the H. W. Johns-Manville Company in 1902. He organized the railroad and United States Government departments of this company in 1906, and has held the position of general manager of same up until his present promotion. He still retains direct supervision of these departments in addition to other duties.

Trade Publications

Clamshell Buckets.—The Blaw-Knox Company, Blawnox, Pa., has recently issued a large size, 52-page, illustrated booklet, descriptive of clamshell buckets, cableways and other rehandling devices manufactured by this company. All of the various types of buckets, for specific and general purposes, are shown in photographs and drawings and their mechanisms and use given in the text. In addition to showing each of the types of buckets in detail, photographs are included showing their application in actual construction or other classes of work. Detailed tables are also included giving dimensions, weights, capacities, class of materials, clearances and other data for use in material handling.

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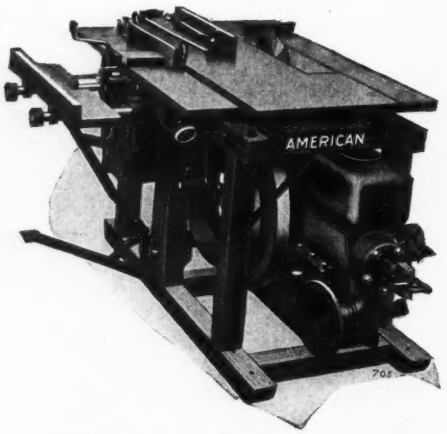

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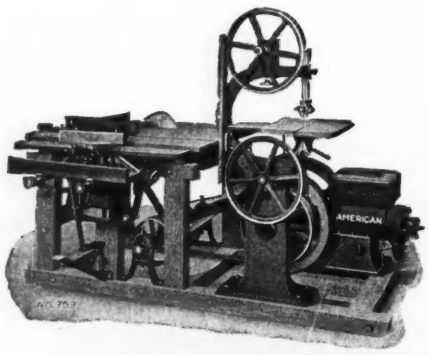

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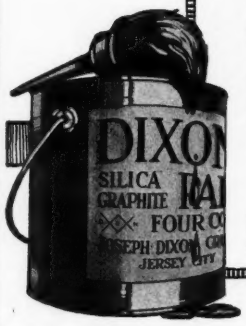

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Diamond Fibre Railway Insulation is always on guard. It is dense and tough. It does not crystallize under severe vibration. Resistance to absorption is unusually great.

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For special purposes, where exceptionally high electrical properties are essential, Celoron is the ideal material.

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all too often describes the policy of laying ordinary 1¼ to 2-inch pipe. For in a few years rust and leakage demand heavy and costly replacements.

To end these wastes, adopt

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Flexibility, positive joints, ease and speed of laying, and low cost per foot and per year follow its use. Nearly all of America's largest railroads now use McWane small cast iron pipe.

Economy and simplicity of laying distinguish McWane Precalked 4- and 6-inch mains. No lead pouring, no yarning, no bell holes, yet a bell and spigot type of joint.

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How many of your water columns are knocked down every year?

What does the repairs and maintenance—not the result of ordinary use—cost you?

Avoid this annoyance, trouble and expense by using a

How lateral movement of spout prevents column being knocked down

The open telescopic joint does not waste a drop of water. It banishes the usual winter time troubles. Ice does not collect upon it.

The valve permits the maximum amount of water to flow in the shortest time. There is a minimum of frictional resistance. It shuts the water off quick without water hammer.

Try the Poage Style H column. You will find that it has remarkable operating advantages.

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The three foot lateral range in the Fenner spout and the steel riser in the Poage Style H save the water column from being knocked down by the shifting of the tender.

The tender has to leave the track to knock this column down.

The flexible spout makes it unnecessary to spot the tender accurately. You save time by quick adjustment.

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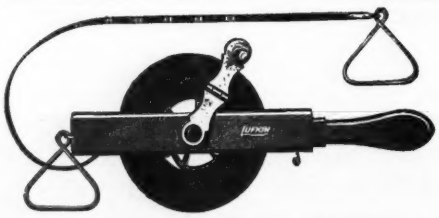

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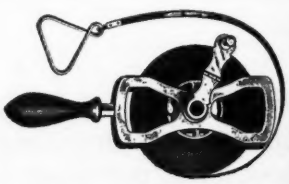

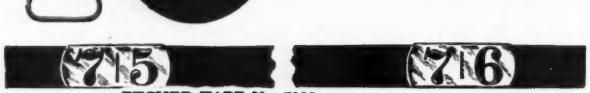

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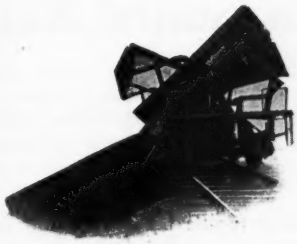

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No harm.

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Pressed Steel Throughout. Weight 30 Lbs.

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"With reference to a couple of Dreadnaught Buckets which we bought from you about a year and a half ago, we wish to say that one of these buckets has seen continuous service for at least seven months and during this time we have had no trouble and no repairs whatsoever.

We found that it will handle material which is hard to dig with an Orange Peel Bucket, at least twice as fast, thereby decreasing the cost for excavating such material. So far we have not found any material, except rock, which we could not dig with the bucket.

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Chew off big bucket loads

The Blaw-Knox DREADNAUGHT has well shaped digging scoops—with tremendous lever arm power behind them for forcing through packed broken stone, bank gravel, clay and other hard packed materials—heaping up big loads in any material which can be "clammed" at all.

Built by master builders to stand the gaff of hard continuous digging—a Blaw-Knox Dreadnaught Bucket *lasts. Rope wear* and *bucket wear* are reduced to a minimum.

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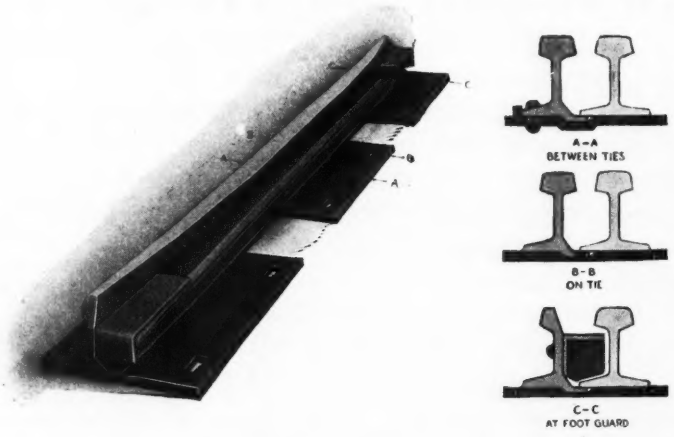
BLAW-KNOX BUCKETS

Bethlehem Rolled Steel One-Piece Guard Rail



The Rolled Steel One-Piece Guard Rail here illustrated is rolled with a depressed flange on one side which hooks under the base of the running rail its entire length, thus positively preventing overturning.

Three heavy two-tie base plates and the foot guards at each end are permanently attached, forming a complete unit ready for installation. No clamps, braces, tie plates, foot guards, filler blocks, or bolts are required.

Bethlehem Rolled Steel One-Piece Guard Rails are recommended for high speed main line as well as yard service. They are easily and quickly installed, can be adjusted for wear, and reduce maintenance charges to a minimum.

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Can now be taken down and replaced by one man from the ground.

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We can eliminate your entire labor costs and make your bridge and tunnel warnings 100% efficient.

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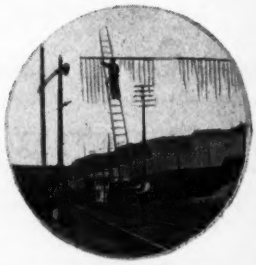

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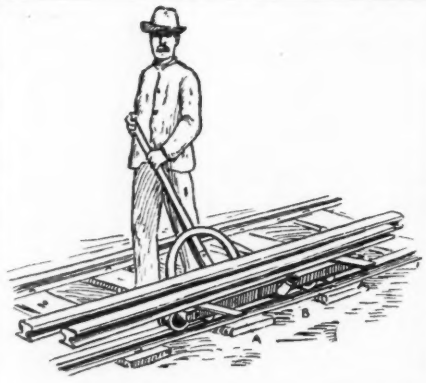

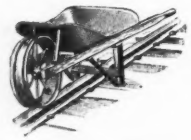

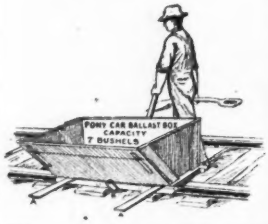

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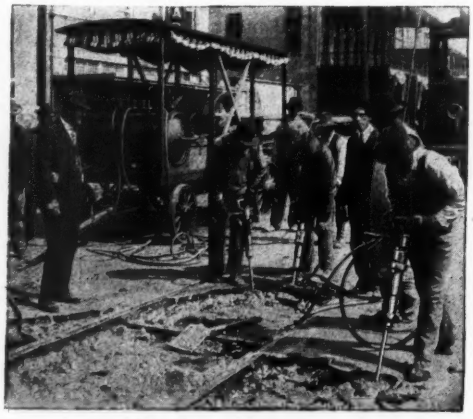

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This picture from Mobile, Alabama, shows how The Mobile Light & Railway Company is using Sullivan Concrete Busters to speed up concrete removal in a busy city street.

The drills are "DC-19," 40-lb. and "DB-21," 65-lb. Concrete Busters operated by a Sullivan single stage compressor, driven by short belt from electric motor, mounted on the truck. This outfit has greatly expedited the Company's repair work, and at the same time, has cut down the number of men required for this job. From 2400 to 2700 square ft. of pavement 8 to 12 in. thick are removed per day with this outfit.

Send for Bulletin 1981-D

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Specialists in the Design and Manufacture of

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"You have to know everything on this job"

said one Maintenance Man, after the Man Higher Up had pointed out that the trouble with his bridge piling was due to a small wood-boring mollusk called Xylotrya.

"Handling steam shovels and so on calls for mechanics, and then you put in a pump and learn hydraulics. Laying a track calls for trigonometry, and to kill the weeds on it you have to know botany and chemistry. A Maintenance Engineer has to be a walking bureau of information."

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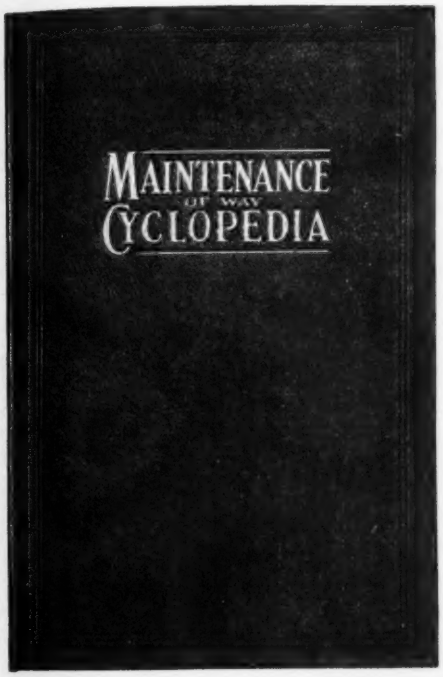

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Appliances and tools needed for water service work are described and pictured in a comprehensive manner.

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Treats the subject fully, including a key for the identification of woods as well as specifications for different preservative treatments.

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Information regarding construction and camp equipment, as well as a large number of tools and devices which are used in more than one of the foregoing sections is given.

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Describes in a specific manner various machines and appliances used in maintenance work and where they may be obtained.

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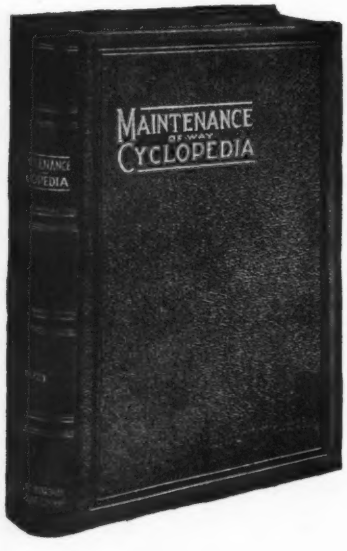

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You may be called on to give correct answers to these questions at a moment's notice

WHAT are the standard clearances for railway bridges and tunnels? Where can I find detailed drawings and layouts of standard frogs and switches; tie and track bolt specifications; layouts of turnouts and cross-overs?

Answers to these questions and thousands of others will be found in the Track Section of *Maintenance of Way Cyclopedia.*

Railway bridges?

You will find among the eight sections of the Cyclopedia one whole section full of accurate information on the subject.

What are the current-day designs used in the varied types of railway buildings?

The Building Section tells you.

What about Water Service? The pipes, tanks, machines and treatments used?

Turn to the Water Service Section and see.

What are the fundamentals of modern signal practice? What systems are used? How are they operated?

The Signal Section explains fully, and like the other parts it's in simple English.

Check up the needed facts and figures in Maintenance of Way Cyclopedia

What are the best methods of Wood Preservation? How can the different kinds of wood be identified with the aid of a hand lens?

The Wood Preservation Section disposes of these questions and hundreds of others.

What of the material, machines and tools used in general maintenance work? What equipment is necessary for a temporary camp; a boarding train?

These are but a few of the questions solved in the General Section.

Where can I obtain the various materials, machines and tools necessary?

The Catalog Section contains hundreds of pages in which leading manufacturers describe and picture their products and the uses to which they may be put.

There are over 860 pages chock-full of the very information you need in your work.

Written by Maintenance Men *for* Maintenance Men

E. T. Howson, Western Editor of the *Railway Age*, and Editor of *Railway Engineering and Maintenance*

E. R. Lewis, Formerly Chief Engineer of the Duluth, South Shore & Atlantic R. R.

K. E. Kellenberger (Signal Section), Editor of the *Railway Signaling*

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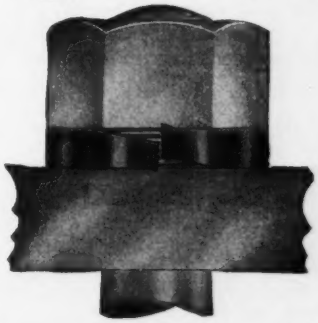

The serious consequences of a loose nut or a lost bolt does not have to be considered if

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are holding them!

They are in place—seen or unseen—performing the perfect function of a dependable nut lock.

Vibration and shock encourage them to "bite" all the deeper. The hardened steel barbs "get to" the nut and metal backing without injury to threads. It's all in the design.

We also make Plain Type Lock Washers.

The POSITIVE LOCK WASHER CO.
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Keep Signals Working With Less Trouble In Wet Weather

DURING the Spring rainy season insulated rail joint fibre is subjected to many additional strains which excessive moisture causes both on the road bed and on the fibre itself.

In making insulation replacements under ALL weather conditions, many of the leading railroads use only

WHALL'S
Special Railroad
FIBRE

This widespread preference has extended for nearly 40 years and has covered the entire development of rail joint construction from the old 4½-inch rails to the 130-lb. rails of today.

Many roads which placed their first orders for WHALL'S FIBRE thirty years ago are using it today, because they have found it

Unequalled for Long Wear

During all these years WHALL'S *Special Railroad* FIBRE has continuously demonstrated its long wearing quality under the severest test to which it could be subjected, *i. e.*, as replacement fibre in insulated rail joint renewals.

Under every climatic condition and in every type of service, it has proved superior in resisting the abnormal strains due to rust, distortions, occasional fractures and the other impairments which these renewed joints develop in use.

Because it wears longer, its use results in

Lower Ultimate Cost

of maintaining the signal system in proper working condition.

Manufactured only by

C. H. WHALL CO.

Pioneer Manufacturers of HARD FIBRE For Rail Joint Insulation

170 Summer St., Boston, Mass.

Are You Going to *Get* Your Share?

In 1923, the railroads spent over one billion dollars for improvements in their properties in addition to equally liberal expenditures for maintenance. Roughly speaking, two-thirds of the total expenditures went for equipment and one-third for roadway and structures.

During 1924, present prospects indicate that these percentages may be reversed—at least to the extent that greatly increased expenditures will be made for additions and improvements to the tracks and structures.

THE REASON IS OBVIOUS

In 1923 the roads were confronted with what might easily have become an excess of traffic. Cars and motive power were the immediate necessity. Every dollar that could safely be so expended went for equipment. Construction and maintenance of way expenditures, while liberal, were secondary to equipment. Many improvements waited.

In 1924 a very heavy traffic will still be within the present enlarged equipment capacity of the roads to handle it. But it must be handled within narrower limits of expense per ton mile and per train mile. This means a greater proportionate expenditure for maintenance of way and roadway betterment. "Reduce Operating Costs" is the slogan for 1924.

Traffic is now heavier than last year and though not so heavy during the first few weeks of the year the record of car loading is now better than ever before. This means increased wear and tear on roadway and track, increased expenditures to take care of wear and tear and increased earnings to take care of the expenditures.

A FEW PERTINENT FACTS

From budgets already prepared it is shown that one road is planning to expend $70,000,000 in improvements. Another has set aside $50,000,000, and two others have plans calling for $40,000,000 each; while the estimates of several roads call for expenditures of from $12,000,000 to $18,000,000. These are only a few of the larger items.

These plans include a large amount of second and other multiple track, the enlargement of terminal facilities, etc., which will require large tonnages of rails, joints, tie plates and other track accessories, as well as the tools and appliances for doing the work. Other improvements will require other materials and supplies in similar proportions.

This work comes within the field of

RAILWAY ENGINEERING AND MAINTENANCE

Its pages afford the medium through which to make known your products which will necessarily be in demand.

You cannot afford to miss the opportunity its advertising pages afford for engaging the attention of over 8,000 of the men who will authorize the supplies for this year's comprehensive program.

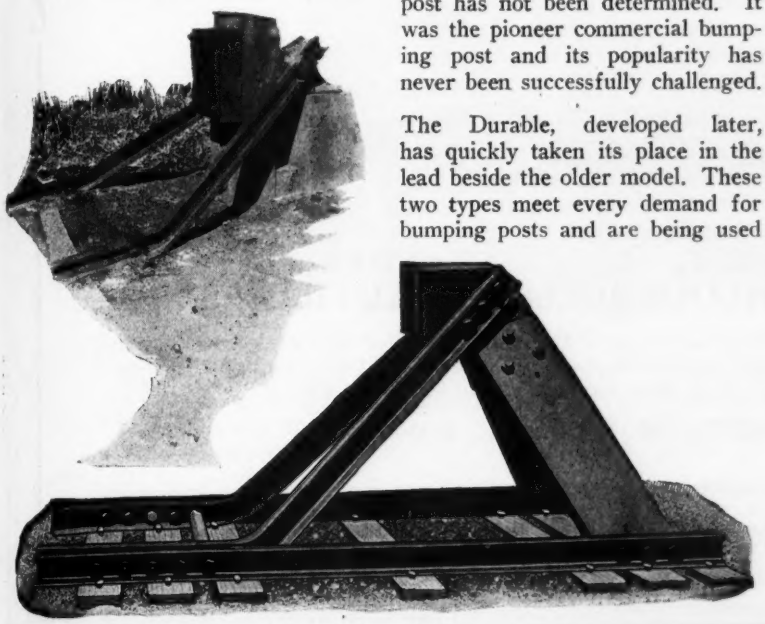
Ask us for further particulars

Railway Engineering and Maintenance
608 So. Dearborn St., Chicago.

Are You Going to *Do* Your Share?

The Pioneer and Still the Leader!

THIS unretouched picture shows an Ellis bumping post in service over 15 years.



There are many similar installations, 15, 20 and 25 years old. The full measure of the life of an Ellis post has not been determined. It was the pioneer commercial bumping post and its popularity has never been successfully challenged.

The Durable, developed later, has quickly taken its place in the lead beside the older model. These two types meet every demand for bumping posts and are being used today in larger numbers than all other commercial posts combined.

The Ellis is used where safety and property protection demand that cars be stopped at any cost. The Durable is specially fitted for locations where simplicity of installation, all parts above ground, all-steel construction, and minimum occupancy of track space are the most desirable features. The best results are assured when both types are made standard, and the choice between them for any particular location is based on a careful consideration of the local requirements.

Ask for our literature describing these types and giving instructions for installation.

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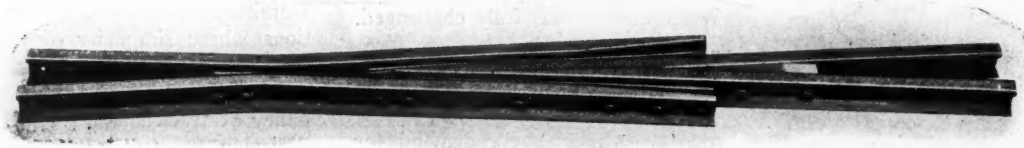

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Wharton trackwork is standard; the adoption of Manganese Steel for trackwork was originated by this company. We are prepared to furnish special trackwork to fit any condition; switches, frogs, crossings, etc. Bulletins covering these products will be sent upon request.

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Over 100,000 freight and refrigerator cars have been insulated and waterproofed with Mule-Hide, in the last 10 years. The Lehon Company is still able to maintain its enviable service record of

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Discriminating railway men have found that MULE-HIDE "stands the gaff" that railroad service gives.

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Manufacturers
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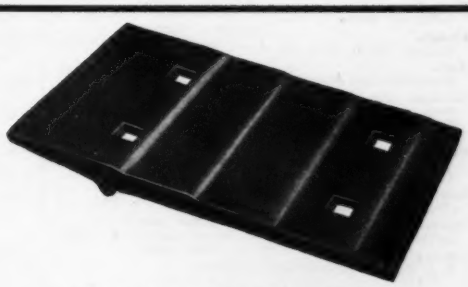

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Requires only one anchor per rail.

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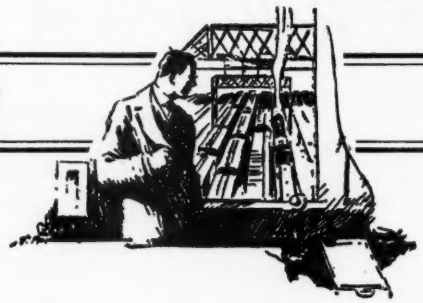

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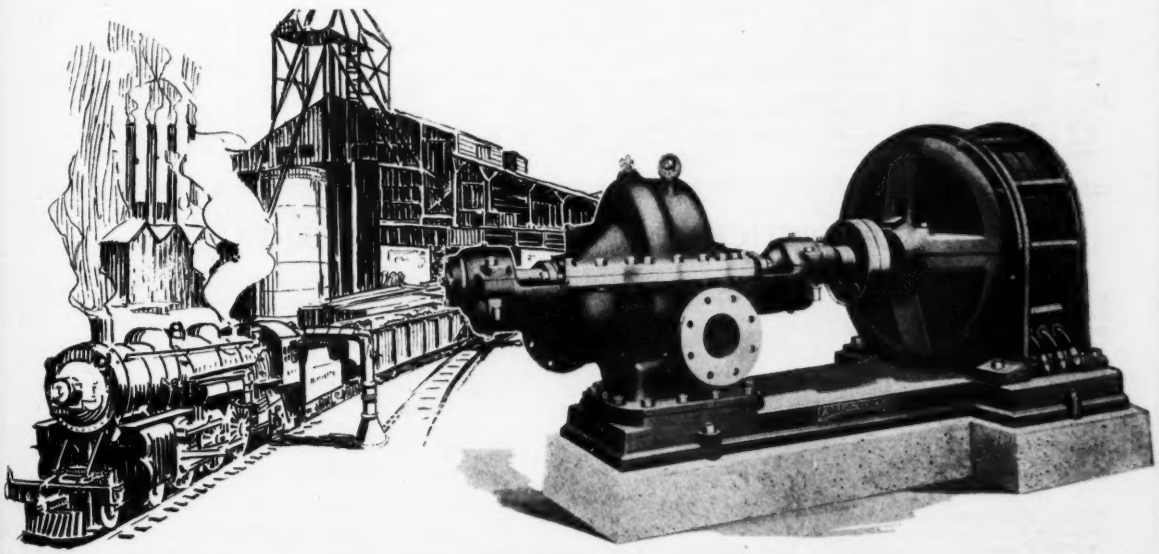

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Wood's "MOLY-D" Handle

Ring prevents grip from turning. Steel caps reinforce prongs—no rivets. Prongs extra thick. Wide grip. Grip cannot check or split. Grain of whole handle against the strain, not with it. Fewer broken handles.

The most progressive of all Wood's shovel improvements

FIRST, Wood gave the world the Mo-*lyb*-den-um Steel Shovel—harder, tougher, lighter than any shovel made. In thousands of tests, Wood's Mo-*lyb*-den-um Steel Shovels conclusively proved that they outwear other shovels two to six times.

Next Wood put a *Step* on the shovels—acclaimed the greatest shovel improvement in years. Already preferred by the men because of its lightness, Wood's Mo-*lyb*-den-um Steel Shovel with the *Step* became even more their favorite. The Step aided them in their work, and eliminated that soreness often caused in wet weather by pushing the foot on a sharp edge. Also, it saves shoes and stiffens the blades, insuring longer life to the front strap welds.

Now Wood has put a new handle on that shovel that is absolutely without an equal. Any man who handles a shovel knows *that* the minute he wraps his fingers around "Moly-D." A big grip that takes all his fingers easily—a smooth grip that can't check or split—a firm grip that can't twist or turn no matter what happens. Extra thick, strong prongs, with no rivets to weaken them. Everything a man could want, and has never had before.

Mo-*lyb*-den-um Steel—the Step—the "Moly-D" handle. For the men—better work, easier work. For the buyer—phenomenal wear, contented workmen, shovel economy. Let us give you immediate information on the application of Wood's Shovels to all your needs. Write to-day to

THE WOOD SHOVEL & TOOL COMPANY
Piqua, Ohio, U. S. A.

The third great improvement "MOLY-D"
The second great improvement The Step
The first great improvement Mo-lyb-den-um Steel

Wood's Mo-lyb-den-um Shovels

The American Super Steel

You tighten once when the rail is laid.

Three times —then forget it

Again a week later when the joint has settled down and seated itself.

Once more, about a month later to take up for initial wear.

EVEN with Verona Rail Joint Springs it is advisable to tighten bolts twice after the first application. Then, when the joints are once tight, they will remain tight for the life of the rail.

Bolts may stretch, but they will not become loose. They may rust, but they will remain tight. They may wear, but they will not loose their effectiveness. The Verona Rail Joint Springs, exerting their terrific reactive pressure, and delivering it thru a distance far greater than any other nut-locking device, compensate for all the usual failures of other parts of the joint.

The springs simply eliminate periodic bolt tightening. They do their own tightening more efficiently than any track gang can do it. Apply springs, tighten three times—then forget it.

VERONA TOOL WORKS Pittsburgh New York Chicago Boston St. Louis San Francisco New Orleans Montreal Washington